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MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

JUNE, 1834.

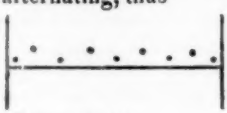
On the Seams, or Joints, of Steam-boilers. *By* Thomas Ewbank, *of New York city.*

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

To justify inquiry into the minutiæ attending the formation of steam boilers, it is perhaps sufficient to observe that no general rule is adopted by workmen in putting them together; and that human life frequently depends upon the skill and workmanship employed in their construction.

The following remarks are designed to call attention to the seams of boilers, and to show the utility of instituting a series of experiments to determine their relative strength. This will appear the more necessary when it is considered that the strength of boilers has been calculated on the cohesion of the solid part of the sheets or plates, without reference to the seams. The tables of Oliver Evans and others are thus constructed.

In order to unite by rivets two plates of metal in the strongest possible manner, several particulars are necessary to be attended to—as the length and diameter, or thickness, of the rivets—their distance from each other—their distance from the edge of the sheets, or what extent of lap each sheet should have—their direction, whether in a right line, as usual, or alternating, thus



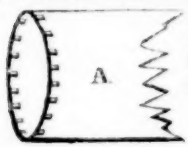
That there is a medium in all these, and some other particulars, the best calculated to secure strength in the seams, cannot be doubted. To determine it by experiment, the only sure way, would be of great practical importance.

The length and thickness of rivets, and other particulars relating to them, will depend upon the thickness of the plates they are intended to unite. In working thin sheet iron (when the effects of riveting are easily perceived,) with cold rivets, a good joint cannot be made, if they are either too long or too thick. In the former case the heads of the rivets are liable to burst, and in the latter, the holes to be enlarged. When too long, they also become hardened by hammering, and are liable to break. In forming steam boilers, the rivets are heated, and the plates being thick these results are not so obvious; yet they are sure to be produced in proportion as these causes are suffered to exist.

Supposing the average thickness of rivets to be .625 inch, and that of the plates .25, can the size of the rivets be reduced without injury to the joint? Or, would those of smaller dimensions, and an increased number of them, be preferable? It would seem that they should be sufficiently strong to endure a strain equal to the cohesive force of the plates at the joint, and *no more;* for if their thickness be unnecessarily enlarged, the strength of the plates will, in the same ratio, be diminished, by the extra portion of their substance punched out.

Another inquiry is, What is the proper distance of the rivets from each other? This is evidently important, because the strength of the plates on the line of the joints, is inversely as the number of the holes, or their sum collectively. Admitting the rivets to be half an inch in thickness, and the distance between each one inch (a common proportion) the strength of the plates at the joints is reduced *one-third* below that of the body of the plates:—or, taking the proportions in the boilers of the New England as the average, it is still further reduced, the holes being .625, and the distance between each 1.125. Hence it would appear that no joint can be so strong as the body of the plates. And from all calculations on the strength of boilers predicated on the tenacity of the metal, full one-third should be subtracted; that amount at least being always punched out in every joint for the rivets.

The distance of the rivets from the edge of the plates should also be determined. The holes for them should be made at such a distance that the texture of the metal between them and the edge should not be disturbed. Is there not some danger in this respect when they are but three-eighths of an inch from it? I have noticed some high pressure boilers where the rivets that secured the ends of them were less than that distance from the edge. In such cases it appears very possible for those ends to be blown out, in consequence of the small portion of metal opposite each rivet giving way, as at A.



It appears to me that in all joints or seams, the

centre of the holes should never be nearer the edge of the plates than twice the diameter of the rivets. This point, however, can only be satisfactorily determined by experiment.

Every one acquainted with the working of sheet iron is aware, that it is frequently formed of layers, or strata, which are imperfectly united, so that in punching a hole, or in cutting the edges, the space between the layers is often opened and made visible, which is another reason why the plates should lap over each other to the extent indicated. On this account, iron boilers require more lap than copper ones, the latter metal not being so subject to those defects.

Remarks on the Height of the Aurora Borealis, with a review of the accounts of some of the most remarkable Auroral Arches. By JAMES P. ESPY.

[Continued from p. 182.]

I might here terminate the discussion, as I have shown most conclusively that the auroral arches which have been the subject of this investigation, were not five miles high, and probably not more than two; but I shall adduce other proofs which will be satisfactory to those who may not choose to follow me in the preceding investigation. And first I shall give an account of a splendid aurora borealis as seen at the observatory of Gosport on the 7th of January, 1831.

In the afternoon of this day, there was a peculiar brightness in the atmosphere near the horizon, for several degrees on each side of the true north point which indicated the approach of an aurora; indeed, we have reason to suspect that it was a faint appearance of one; while the sun shone in all his splendour, without the interposition of cloud or vapour. Shortly after sunset an aurora borealis gradually rose above the northern horizon, and at a quarter past five o'clock it had assumed the form of an arch of refulgent light, ten degrees in height, and seventy degrees in width. From this time till half past five it continued to increase in the intensity of its light, expanding to the western point of the horizon, and fifty degrees to the eastward of north, which made the chord of the aurora 150°. Now, a bright *flame-coloured* rainbow-like arch, between three and four degrees broad, and pretty well defined at its upper edge, emanated from the curved edge of the aurora to an altitude of thirty-five degrees; and while it remained apparently stationary, a beautiful rainbow-like arch, still more brilliant, formed about ten degrees south of the zenith, by streamers suddenly springing up from the N.E. by E. and W. by S. points of the horizon, and meeting in the zenith, so that these two bows presented themselves at the same time. At thirty-five minutes past five, the latter bow, in some parts four and in others six degrees in width, divided a little to the eastward of the vertex; and the long streamers which formed it passed off gently to the southward in very bright patches, two in the south-east and one in the south-west quarters, like

luminous clouds, and continued in sight nearly a quarter of an hour. One of these bright patches nearly covered Orion several minutes. At forty minutes past five another rainbow-like arch, equally wide and bright, was formed by long streamers from about the same points of the horizon, whose point of convergence was the same, and its course through the feet of Gemini, near the Pleiads, through Aries, the Square of Pegasus, the head of Equulus, and the Bow of Antinous. It passed off gradually towards the south, and at a quarter before six, the planet Mars, then near the meridian, and about forty-five degrees in altitude, rested, as it were, conspicuously on it. At six, it had gone far towards the southern horizon, and could scarcely be perceived, leaving the sky unusually clear and bright. By this time the bow over the aurora had much increased in altitude, and was nearly effaced.

At a few minutes past six, after a great many coloured columns of light had risen from the north-east and north-west quarters, and passed the zenith, the aurora sunk considerably towards the horizon, but its upper edge remained bright and very well defined. Some of the streamers, or columns, were long, others short, and the widest generally remained long enough to pass through a gradation of prismatic colours. At half past six the aurora again increased in altitude, and vivid coruscations radiated from every part of its arch, and on intermixing with each other, formed wide columns which were so grand, with crimson tints, as to astonish every spectator. Between seven and eight, the aurora had spread at least two-thirds over the heavens, and as far as the shoulders of Orion on the eastern side of the meridian, where large perpendicular columns, and short pointed luminous coruscations, rising from the aurora, glittering like spears and conical points in nearly parallel rows, now mixing, and then dividing, all passed through red, orange, lake, crimson, green, and purple tints; so that the appearance altogether, over so great an extent of the heavens, was exceedingly grand, particularly when contrasted with the cerulean sky, and its spangled constellations, in the southern portion of the hemisphere. At ten minutes before eight the aurora was in its greatest splendour. At five minutes before eight, another luminous rainbow-like arch, stretched across the heavens from the eastern point of the horizon, and displayed several prismatic colours while passing southward. Soon after eight, a large dark space, in, and near, the horizon, presented itself several degrees on each side of the magnetic north, and the aurora, still far over the heavens, gradually diminished. At nine, it again ascended, and wide columns rose from every part of its arch, and passed through the same colours as before mentioned. Between nine and ten the magnetic needle, which in the early part of the evening stood at twenty-four degrees west of the true north, was disturbed, and receded upwards of half a degree northward, either by the influence of the aurora, or by a change of wind from north-east to south-west, and of course a change in its electrical state. At a quarter before eleven there was a grand display of about twelve or fourteen glowing columns from the aurora, several of which passed beyond the

zenith, when a perfect, red, rainbow-like arch, ten degrees above the aurora, was visible. At eleven, another bow, three degrees and a half wide, rose from the aurora, and passed through Aries, Cassiopeia, Ursa Minor, and the square of Ursa Major, until reaching the zenith, it gradually disappeared. At half past eleven the aurora again began to sink slowly, and did not rise afterwards. At five minutes before twelve, a large brilliant meteor, the only one observed through the night, passed Ursa Major. At one o'clock, A. M. the highest parts of the aurora about the magnetic north, had sunk to within six or seven degrees of the horizon; yet bright coruscations occasionally emanated from it till two, when the observations were discontinued, as no more interesting meteoric appearances were likely to occur.

I will now adduce some facts from which a cursory reader, without wading through the preceding dry investigation, will be able to draw the conclusion, that the aurora is certainly very near to the surface of the earth.

During a brilliant aurora which appeared at Edinburgh on the 5th of December, 1801, a noise was distinctly heard by Dr. Brewster, who at that time published the following description of it—

"The whole northern part of the horizon was covered with a thin, transparent, luminous cloud, which emitted almost as much light as the moon when three days old. This luminous cloud sometimes appeared settled, and totally free from all manner of motion or agitation. At other times, the agitation was extremely great, and the coruscations, or streams of light, which were perpendicular to the horizon, flew with the utmost rapidity from east to west, and from west to east. One of these coruscations, which appeared in the north-west, was about thirteen degrees long, and one-half of a degree broad. Its western edge was tinged with red and violet, and its brilliancy was almost equal to that of the moon in her first quarter when the sun is a few degrees below the horizon. * * * During this evening a *whizzing noise* was heard in the air, exactly similar to the sound which accompanies the passage of the electric spark from the glass cylinder to the conductor; and I was informed by a friend that during the time that the coruscations were most vivid, the top of St. Giles' steeple seemed to emit rays of light in every respect similar to a Leyden jar when surcharged with the electric fluid."

Wargentin, in the fifteenth volume of the Transactions of the Swedish Academy, says that Dr. Gister, and Mr. Hellant, who had resided for some time in the north of Sweden, made at the request of the Academy, a report of their observations on the aurora borealis.

The following is an extract from Dr. Gister's account:—"The most remarkable circumstance attending the northern lights, is, that although they seem to be very high in the air, perhaps higher than our common clouds, there are yet convincing proofs that they are connected with the atmosphere, and *often descend so low in it, that at times they seem to touch the earth itself, and on the highest mountains they produce an effect like a wind round the face of the traveller.* He also says, that he himself, as well as other credible persons, "had often

heard the rushing of them as if a strong wind had been blowing, (although there was a perfect calm at the time,) or like the whizzing heard in the decomposition of certain bodies during a chemical process." It also seemed to him that he noticed "a smell of smoke or burnt salt." "I must yet add," says Gister, "that people who had travelled in Norway, informed me they had sometimes been overtaken on the tops of mountains by a thin fog very similar to the northern lights, and which set the air in motion; they called it sildebleket, (Haring's lightning,) and said that it was attended by a piercing cold, and impeded respiration." Dr. Gister also asserts, that he often heard of a whitish gray fog of a greenish tinge, which, though it did not prevent the mountains from being seen, yet somewhat obscured the sky, rising from the earth, and changing itself at last into an aurora; at least, such a fog was frequently the forerunner of this phenomenon."

Mr. Nairne is confident that he has heard a hissing and whizzing noise when the polar lights were very bright, and M. Cavallo affirms that more than once he has heard a crackling noise from polar lights. Giesecké, who resided in West or Old Greenland, says, "the polar lights sometimes appear very low, and then they are much agitated, and a crashing and crackling sound is heard, like that of an electric spark, or the falling of hail.

Professor Hansteen says we have so many certain accounts of the noise attending the aurora, that the negative experience of southern nations cannot be brought in opposition to our positive knowledge; and concludes with stating that he himself knows several persons who have distinctly heard the same sounds; he expresses his surprise that a fact so well established should be called in question, and he relates, with some sharpness, a conversation he once had on this subject with an Englishman, who remarked that the Norwegian tales of noises proceeding from polar lights, were akin to the ghost stories of his country.

No noise has ever been heard to proceed from the aurora either in the United States, or in the southern parts of Great Britain, nor did Capt. Franklin witness it himself, but he says the uniform testimony of the natives, and of all the older residents in the country, induces him to believe that it is occasionally audible.

Dr. Richardson frequently observed the lower surface of nebulous masses illuminated by polar lights; a fact illustrative of the comparatively low situation of these auroræ, which could not have been higher than the region of the clouds.

Capt. Franklin, in like manner, observed low auroræ. "The important fact," says he, "of the existence of the aurora at a less elevation than that of dense clouds, was evinced on two or three occasions this night, 13th February, 1821, at Fort Enterprise, and particularly at 11 hrs. 50 min., when a brilliant mass of light, variegated with the prismatic colours, passed between a uniform steady dense cloud and the earth, and in its progress completely concealed that portion of the cloud which the stream of light covered, until the coruscation had passed over it, when the cloud appeared as before."

Capt. Parry, as stated in his third voyage, observed auroræ near to the earth's surface. It is said, that while Lieutenants Schener and Ross, and Capt. Parry, were admiring the extreme beauty of a polar light, they all simultaneously uttered an exclamation of surprise at seeing a bright ray of the aurora shoot suddenly downward from the general mass of light, and between them and the land, which was only 3000 yards distant. The ray or beam of the polar light thus passed within a distance of 3000 yards, or less than two miles, of them. Further, Mr. Farquharson observed in Aberdeenshire an aurora borealis not more than four thousand feet above the level of the sea, and he agrees with Richardson, Franklin, &c. in believing that the auroræ occurs in a region immediately above that of the clouds, and of course vary in height with the different states of the atmosphere. But although this region was very low on the 20th of December, 1829, in the polar light seen from Alford, we know that at times it is several miles high, agreeing with the observations of these intelligent travellers. We have frequently seen the aurora when the height of the clouds could not be estimated at less than two or three miles, and at other times not higher than a thousand or fifteen hundred feet. The arches are sometimes close together, and are probably thin fringes, leaning towards the south, as appears from the observation made at Cumberland house on the 6th and 7th of April, 1820, when the whole northern sky to the zenith was filled with wreaths and flashes, which assumed the shape of arches after they passed some distance to the south of the zenith.

The centres of the arches were often carried from the zenith sixty or seventy degrees to the south, while the extremities did not materially alter their positions; and on two occasions at Cumberland House the centres of arches were not more than ten degrees above the northern horizon, when their extremities reached the east and west points of the compass. The number of arches seen at any one time seldom exceeds five, and is seldom limited to one. The arches generally cross the magnetic meridian at right angles; when two or more are visible at once they are concentric, and tend to the magnetic east and west, the streamers in the direction of their length, are parallel with the dipping needle; the number of arches often increased or diminished in their advance to the zenith. The revolution of an arch from north to south occupies a space of time from twenty minutes to two hours; their velocity in general was not so great at Cumberland House.

Evidence is not wanting, also, in the United States, that different auroral arches are seen on the same evening at no great distance from each other.

On the seventeenth of May, 1833, an auroral arch was seen at Saratoga, in the state of New York, of which the following is a description by an anonymous writer. "Choosing to step into the street at about a quarter past nine o'clock, I was surprised at the universal brightness of the night. The sky was rather hazy, and heavy piles of clouds hung in the north, from behind which a flood of light was beam-

ing, tinging their edges with silver. Presently there shot up broad beams of light from the north-west, followed in rapid succession by like streams of every size and form, chasing each other high over the zenith. The clouds in the north soon in a great measure disappeared, and the body of light forming the magazine whence issued the streams before mentioned, expanded so as to cover nearly one-fourth part of the heavens. No blazes of light however shot up from the north; but the flashings from the north-west streamed over two-thirds across the span of the heavens, forming at times, and for a moment, a brilliant arch of light, and then breaking into a thousand fragments, darting and twinkling about in every fantastic form.

"At half past nine, counter columns of light began to shoot up from the E.N.E. These were not so brilliant as those proceeding from the north-west; but they stretched up until the pillars met from both directions, and by meeting together formed a kind of luminous coronal, floating about the zenith. There was no variation of colours—no streams of lake and purple mingled with the silver—but the spectacle was one of surpassing beauty and grandeur. The streaming pillars from the two directions thus meeting in the centre of the arch, diverging to the horizon like a pair of extended compasses, were well defined for the space of ten minutes. But it is impossible for me to give any adequate idea of the grand effect of this magnificent display of the fire-works of the sky. The undulations of the masses of light—the brilliancy—the breakings off into myriads of beautiful forms—curling in as many wreaths and folds—the radiance, bright as the silver veil of the Prophet of Khorassan, imparted a grandeur and glory to the exhibition which I can never forget. At one time, I could count the minutes on my watch dial by the light, and I succeeded in reading a bit of manuscript which I happened to have in my pocket. At ten o'clock the flashings ceased—the clouds of light gradually disappeared over head; and in fifteen minutes nothing remained of the magnificent phenomenon, but a mass of strong, still brightness in the north."

On the same evening, an arch of aurora was seen at Philadelphia about 200 miles south of Saratoga. An account of this arch was given by Professor Bache in this Journal, vol. xii. p. 5. It is enough for my present purpose to state that these arches could not have been the same, as the arch at Saratoga made a bend in the zenith of sixty or seventy degrees, whilst the one at Philadelphia stretched entirely across the heavens in one uniform direction.

P. S. After I had terminated the above investigation, the December number of the Philosophical Journal arrived from Europe, containing another attempt to prove that auroral arches are far above the region of the clouds.

From the account given by Mr. Potter it appears that on the night of the 21st of March, 1833, an auroral arch was seen at Edinburgh, at Armagh in Ireland about 160 miles from Edinburgh, and at Athboy, about fifty or sixty miles from Armagh. From observations made at Edinburgh and at Armagh, Mr. Potter concludes the height

of the arch to be about 142 miles; and if the observations at Armagh and Athboy could be depended upon, the height would be 194 miles; the latter, however, he gives up, but cleaves to the former, and seems very desirous that the public should do him the credit to believe that he by no means countenances the idea that auroral arches are in the neighbourhood of the clouds.

Now, most unfortunately for Mr. Potter's calculations, we have no reason to believe that the Armagh arch appeared at all till after the almost entire disappearance of the arch at Edinburgh. The last observation was made on the Edinburgh arch fifty-five minutes after eight o'clock, and the first observation on the Armagh arch at forty-four minutes ten seconds after eight. Now, allowing thirteen minutes for the difference of longitudes between Edinburgh and Armagh, it appears that the Armagh arch made its appearance just about the time that the Edinburgh arch was disappearing; for after this last observation upon the Edinburgh arch, the observer says it was hardly visible. Again, the Athboy arch did not appear till 9 o'clock, which, allowing for the difference of longitudes, is twenty-two minutes after the arch at Edinburgh had disappeared, or nearly so; and it was observed for twenty minutes after that without any intimation being given of its fading away; and the observer says it had disappeared at 10 o'clock, which is one hour and twenty-two minutes after the fading away of the Edinburgh arch. Now this could not have been the case if there had been but one arch, as supposed by Mr. Potter, at the height of one hundred and forty-two miles. Again it appears from the observations on the Edinburgh arch that its middle moved from between γ and ζ Leonis to α Leonis, ten degrees, in ten minutes, whilst the Armagh arch moved only two degrees in five minutes, or with less than half the velocity of the Edinburgh arch; which could not have been the case if they had been the same arch. But a circumstance, which puts it beyond doubt that the Armagh and the Athboy arch could not be the same, remains yet to be mentioned.

The Athboy observer says, the arch was one degree broad in the east, and increased to five or six degrees in the West, whilst at Armagh no such increase in width was seen. Now as these two places are only about fifty or sixty miles apart, it is certain that the arch, if it was the same, could not have been ten miles high, or much of it would have been seen in common by both observers, and of course its uncommon appearance to the Athboy observer could not have been unnoticed at Armagh.

It may be thought by my readers that I ought to mention Professor Airy's remarks on the auroral arch, as given in the same number of the Philosophical Journal which contains Mr. Potter's investigation. But as all the observations are not given from which the Professor draws the conclusion that the arch was between fifty and sixty miles high, I will merely observe that as I have shown that in the case investigated above there were more than one arch, it is probable in this also there were more than one; more especially as "the observations at Gutsborough gave the altitude of the arch greater than was consistent with the others; and the observations at Armagh, could not

easily be reconciled with those made at other places, either for the elevation or the general appearance of the phenomena."

I hope Professor Airy, who has the original observations, will examine whether the contradictions may not be reconciled by the supposition of more arches than one.

If the aurora is really produced by the overlapping of different currents of air with very different 'dew-points,' as suggested in a paper of last year, it will be easy to show, independent of magnetism, why the streamers are not perpendicular to the horizon, but lean in the direction in which the arch moves, and I think will be likely to have a greater inclination the more rapidly the arch moves. But the development of this idea must be reserved for another time.

In conclusion, I will observe, that as I have now demonstrated that the aurora is from one to three miles high, and as it always has been accompanied by a sudden change of 'dew-point' during the last two years, and as the remarkable meteoric phenomena of the 13th of November last were attended by a sudden and very great change in the 'dew-point,' similar to what occurs when the aurora appears, I am justified in saying that the plausibility of the hypothesis which was formerly advanced to account for the aurora is much increased; but many more facts must be yet accumulated before it deserves the name of *theory*.

FRANKLIN INSTITUTE.

Quarterly Meeting.

The forty-first quarterly meeting of the Institute was held at their Hall on Thursday, April 17th, 1834.

Thomas Fletcher, Vice President, in the chair.

William Hamilton was appointed Rec. Sec. P. T.

The minutes of the last quarterly meeting were read and approved.

Donations of books, charts, models, and minerals, were received from Messrs. George Fox, Carey, Lea & Blanchard, Frederick Fraley, J. Henry Bulkley, Israel White, J. J. Barclay, of Philadelphia, and Petty Vaughan, Esq. of London, and from the society instituted at London for the encouragement of Arts, Manufactures and Commerce.

The actuary laid on the table the various journals which had been received in exchange for the Journal of the Institute during the last quarter.

The chairman of the Board of Managers read the forty-first quarterly report of the Board, which was accepted.

The Treasurer's report for the quarter ending April 1st, was read and accepted.

Adjourned. Thomas Fletcher, V. P.

William Hamilton, Rec. Sec. P. T.

Forty-first Quarterly Report of the Board of Managers of the Franklin Institute.

The Board of Managers respectfully submit to the Institute the following report of their operations for the last quarter.

In compliance with the custom established by their predecessors, the present Board proceeded immediately after the date of their organization to the appointment of standing committees, in whose charge has been placed the important interests of the Society. These committees have, as appears by their reports, been attentive to the duties assigned to them. The subject of Education has always been one of deep interest to the members of this Board. By the committee having charge of this department every effort has been, and will continue to be, used which the means at the disposal of the Board will permit, to enlarge by its operations the usefulness, and the reputation of the Institute.

The course of instruction by lectures was closed on Saturday, the 22nd of March, in an able address on the subject of education, delivered by Dr. J. K. Mitchell, our much esteemed Professor of Chemistry. The just appreciation of this department of the Institute, by the public, is evinced by the unprecedented number of the class which attended the lectures, and the managers have the gratification to announce that the interest manifested at the opening of the course continued unabated at its termination.

The pleasure which they have in making this communication, however, is in some degree diminished by the existence of an inconvenience experienced from the attendance of a large number of minors. It is with much pain that the Board inform the members of the Institute, that in the performance of the duties intrusted to them, the committee on instruction, at an advanced period of the course, found it necessary to exclude the entire class of male minors, in consequence of the disorderly conduct of a *few*, and to readmit such only as had the personal guarantee of their parents or guardians, for their good behaviour.

To prevent the recurrence of this evil, which militates against both the comfort of the adult class, and the high reputation of the Institute, will be the effort of the Board of Managers, and they confidently rely on the support and co-operation of the members of the Institute.

The course of instruction for the session of 1833–34, was subdivided as follows:—*Twenty* lectures on chemistry, and its application to the arts. *Twenty* lectures on natural philosophy, and its applications to, and connexion with, the arts. *Eight* lectures on astronomy. *Ten* lectures on Meteorology. A school for architectural, miscellaneous, and mechanical drawing, and an English school.

The Board of Managers desire to unite their cordial acknowledgments with the warm demonstrations of esteem given by the class, to the several Professors and Lecturers, for the zeal and ability which they have displayed in the service of the Institute. For the schools

under the patronage of the Institute the Board feel the most anxious solicitude; they are both under the care of highly gifted teachers, and present to the apprentices of our city, opportunities for the acquisition of knowledge of the most substantial and useful kind.

The committee on premiums and exhibitions, under instructions from the Board, proceeded to consider the propriety of holding an exhibition for American manufactures during the autumn of the present year, and after mature deliberation have decided against the measure, which decision has been confirmed by the Board.

The committee on science and the arts constituted at the last meeting of the Institute, have enrolled among their members a considerable number of those who are willing to serve the institution in its scientific labours; many, it is believed, have not yet come forward, from a sentiment of modesty, which, however estimable in itself, is deemed to be wholly inapplicable in this case, and to be mischievous in its tendency. No member is required to come forward and declare that he has ability to perform such a duty, but simply to express a willingness to take part in the labours which his colleagues may assign him after they have been intrusted to them by the Institute.

This committee has already organized by the appointment of Prof. A. D. Bache, as chairman, and have, by division into sub committees, taken charge of the unfinished business of the committee of inventions, and of some new business which has been brought before them. In those cases in which the sub-committees have not been required to act simply as counsellors to inventors, their reports will be found upon the pages of our journal.

The subject of weights and measures in this commonwealth, referred by the House of Representatives to the Managers of the Institute, has been reported upon by the committee whose names were stated in the last annual report of the Board. The number of copies of this report required for the use of the Legislature, has been printed under the superintendence of the committee, at the expense of the state, and forwarded to the Secretary of the Commonwealth for transmission to the Legislature.

The subject has, it is hoped, been placed in such a light, and in so simple a form, that should the recommendation to urge upon Congress a general legislation for our entire country not be acceded to, or be deemed likely to produce too great a delay, the Legislature of the state will be able to adopt a system which, while it produces permanent uniformity, will not lead to temporary confusion.

The measures recommended have been to fix existing standards by providing authentic copies of those in use at the period of the declaration of independence, by securing their distribution and preservation, and providing for their restoration when lost or injured, by reference to natural invariable standards. In this recommendation the committee have very properly rejected such reference to scientific deductions, as rest exclusively for their accuracy upon the state of experimental philosophy of the day, and would be liable to change in the advance of science.

The awarding of premiums and medals for improvements in the

arts, from the funds derived from the legacy of the late Mr. John Scott, to the city of Philadelphia, has been vested, for the period of seven years by the Select and Common Councils of our city, in the Franklin Institute, and steps have been taken by the Board of Managers to secure the efficient investigation of articles submitted for the premiums by the committee of science and the arts. The practical experience which may be brought to bear through the medium of sub-committees of that body on inventions, or improvements in the various branches of science or the arts, will secure to candidates, tribunals admirably calculated to appreciate the value of their claims, while in the whole committee, the relative importance of the different branches may be expected to be duly weighed.

The mark of confidence in the Franklin Institute, shown by our city authorities, in the ordinance just referred to, cannot but be highly gratifying to the members; this, combined with the charges intrusted to the Institute by the House of Representatives of our commonwealth, and by the Treasury Department of the United States, serves to show the high estimation in which the disinterested labours of the institution are held, as well at home as abroad, throughout our own state, and by our countrymen generally.

(Signed,) Alexander Ferguson, Chairman.
William Hamilton, Actuary.

Extract from the Minutes of the Stated Meeting of the Board of Managers of the Franklin Institute, held May 1, 1834.

The following communication from the Clerk of the House of Representatives of the commonwealth, having been read, was ordered to be published.

In the House of Representatives,
March 31, 1834.

The committee to whom was referred the communication of the Secretary of the Commonwealth, accompanying the report of the Franklin Institute of the State of Pennsylvania, on Weights and Measures, made report,

That they have read with great interest the report and appendix forwarded by the Institute, and that it appears to them to be a work of great merit, and well deserving the early attention of the House. It evinces research, talent, and judgment, and the committee consider the Institute as entitled to the thanks of the house for the manner in which they have discharged this duty; and they report, without alteration, the two bills drafted by the Institute, and severally entitled—

"An Act to fix the Standard of Measures and Weights in the Commonwealth of Pennsylvania."

"An Act to fix the Denominations of Measures and Weights in the Commonwealth of Pennsylvania."

Extract from the Journal.

Fr. R. Shunk, Clerk.

In the House of Representatives,
April 12, 1834.

On motion of Mr. Crawford, of Franklin,

Resolved unanimously, That the thanks of this House be presented to the "Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts," for the very able and elaborate investigation on the subject of Weights and Measures, undertaken by them in compliance with the resolution of the House of Representatives of the 5th of April, 1833, and for the report made by them on the 24th of March last, in pursuance thereof.

Resolved unanimously, That the Clerk of this House transmit to the Institute a certified copy of these resolutions; and of the report of the select committee to whom the communication of the Franklin Institute was referred.

Extract from the Journal.

FR. R. SHUNK, Clerk.

On motion, it was

Resolved, That the thanks of the Board be presented to the committee on weights and measures, to whose successful exertions in the performance of the important duties delegated to them, the Institute is indebted for the expression of legislative approbation which has recently been bestowed on it.

REPORT OF THE COMMITTEE ON WEIGHTS AND MEASURES.

APPENDIX TO THE REPORT OF THE COMMITTEE OF THE FRANKLIN INSTITUTE ON WEIGHTS AND MEASURES.

Report on the subject of Weights and Measures made to the Commissioners for Revising the Laws of the State of New York. By James Renwick, Professor of Natural Philosophy and Chemistry in Columbia College.

(1.) IT is conceived that it would be inexpedient, indeed it may be said, impossible, to change the present denominations of weight and measure. The terms foot, yard, pound, ounce, bushel, gallon, quart, &c. are identified with our language; and it would be as easy to subvert the form and dialect of our ordinary colloquial speech, as to introduce new standards of weight and measure, with new names. All that could reasonably be attempted, is to refer the units of the several denominations to some measure in nature, constant, determinate and easily determinable, making such slight changes, not appreciable in the transactions of trade, as will tend to the facility of this determination; and, in addition, the means by which the accuracy of existing stan-

dards may be tested in future times, or the standards themselves restored, if lost, must be defined To do more would be to attempt what is wholly beyond the reach of legislative power.

That this view of the subject is correct, may be shown by an appeal to the experience of the people of France. At the breaking out of the Revolution in that country, the steps necessary to form a system of weights and measures entirely different from those formerly existing, and resting not merely for their standards, but for their absolute units, upon a measure deduced from a constant dimension in nature, were undertaken. The result of this investigation was in a system that, if tested by the facility of applying to it the principles of decimal arithmetic, by the scientific and practical skill of the parties employed in the task, or by the great zeal and intelligence shown by them, is deserving of all praise. But in spite of the favourable circumstances existing at that era, when the whole nation was searching after novelties, and no prejudice in favour of any ancient customs could be considered as opposing, it was found that it could not be introduced in its full extent; and that the part on which the proposers most prided themselves, namely, the decimal division, by which it became accommodated to the existing scale of arithmetic magnitude, was the first which required modification. On the 12th of March, 1812, previous to the downfall of the Emperor Napoleon, the ancient denominations of lineal dimension, toise, foot, inch, &c. were restored, but appropriated to measures derived from the metrical system; and since the restoration of the Bourbons, that system has been further modified by the application of the ancient name of pound to the half kilogramme, with which that weight nearly corresponds. Nor does the necessity of making these changes arise from the inveteracy of prejudices, from which the French nation might be considered at the time as almost entirely free, but from causes actually existing in nature. The decimal notation, although long use has made it habitual, is by no means the most convenient for the calculations of arithmetic; it seems to have originated in no other cause than the habit of counting upon the fingers in the infancy of society; and although, from established habit, it would be proper in the ascending scale of weights and measures in ordinary use, and in the descending scale in scientific inquiry, is not applicable to the divisions of the unit in traffic. For this last purpose, a system admitting of binary division is alone fitted; and with this the duodecimal division of the foot is sufficiently agreeable; while it is found in the full extent in the customary divisions of the yard, the avoirdupois pound, and the bushel. Warned, therefore, by the example of the French, we should attempt no change of names, or new methods of division, for the several units of length, weight, and capacity; while, on the other hand, we learn that slight modifications of the magnitudes of either of these, that will render them

more consistent with each other, and with a standard existing in nature, if such be attainable, are perfectly possible.

(2.) It is a well-known and established physical fact, that the pendulum vibrating seconds of mean time in any given place, is invariable in length. That is to say, that if made of a substance susceptible of variation in length with changes of temperature, the variation of its length will be attended with corresponding variations in the time of its oscillations; while, if so constructed as to remain invariable in length, the duration of its vibration in very small circular arcs, and in an atmosphere of unvarying pressure, will be constant: and although no experimental pendulum is invariable in length under differing temperatures, nor the pressure of the atmosphere constant, yet these two circumstances may be abstracted from, by means of corrections deduced from accurate experiments on the law of expansion by heat, and on the buoyancy of the atmosphere. The length of the seconds pendulum varies with the change of latitude, according to a regular and well-known law; and it has lately been shown to be affected by local circumstances. Still, however, the length of the seconds pendulum in a given position, when corrected for changes of temperature, and atmospheric pressure for the magnitude of its arc of vibration, and reduced to the level of the sea, is a standard, determinate and invariable in its dimension, that does exist in nature: it is also determinable, without any great difficulty, by persons furnished with the proper instruments, and possessed of the requisite scientific knowledge. For the best methods of determining the length of the pendulum, the world is indebted to Borda and Kater; and the method of the last is more especially remarkable as one of those brilliant discoveries that mark eras in science, and confer immortality on their inventors. The pendulum then should be recognised in the revised laws as the instrument whereby the standards may be restored, if lost; and with whose dimensions they are to be at present compared, by way of making them comparable with the measures of foreign nations. In confirmation of this opinion, I may urge the examples of the French, the Danish, and the British governments, and that, still more recent, of Sweden.

(3.) As to the mode of determining the unit of length in relation to the standard existing in nature, and of deducing thence the standard of weight, and of measures of capacity:—

I shall assume that the unit of lineal dimension that will be adopted by the State, is the yard in common use on the day of the declaration of independence, as prescribed in the law of 1784. This was, no doubt, identical with the British parliamentary yard made in 1760. It luckily so happens, that we possess the measure of the seconds pendulum made in the buildings of this institution in reference to that very standard, and consequently the

means of making a yard that shall be identical with the yard of the Revolution. For this purpose it will be sufficient that the law should recognise that the standard yard shall bear a certain proportion to that measure of the pendulum. When the necessary experiments shall have been made to determine the true length of this yard, its extremities should be marked upon disks of an imperishable material, (gold or platinum, for instance,) inserted at a proper distance in a bar of brass, or rather of a more durable alloy of copper than what, in ordinary language, is called by that name. The distance between the two extremities of a bar is inadmissible in a standard, in consequence of the alteration in length that is caused by wear, as known in practice in the history of the yard preserved in the British Exchequer.

Such a bar will be subject to dilatation and contraction by heat and cold; but the temperature at which its length is compared with the pendulum should be given, and when it is to be compared with, or its length transferred to, bars of the same material, as both will be equally affected, no legal enactment is in this case requisite; but as measures in ordinary use are most frequently of other materials, it will be necessary that the temperature at which such comparisons must be made, or to which they must be reduced by calculation, should be strictly specified. It would be proper to seek for this purpose a temperature, independent of the indications of instruments that, in the improvement of science, may become obsolete, and constant in all varieties of physical circumstances. Such a temperature is marked in nature while the process of liquefaction is going on, or what is commonly called the freezing point of water. This, therefore, should be declared, in the new law, to be the temperature at which such comparisons should be made, or to which they should be reduced.

The extension in length of the unit of lineal dimension will furnish the elements of measures of a larger size; its square, or that of one of its multiples, will be the unit of superficial measure, and its cube of solid.

To determine the unit of weight, it will be necessary to have recourse to some fluid that can at all times, and under all circumstances, be obtained pure and homogeneous. Distilled water is a fluid of this nature, and the law should declare that the weight of a certain bulk of it shall be equal to a certain defined proportion, or multiple, of the unit of weight. To make this declaration specific, the circumstances under which the comparison is to be made, must be declared in the law; for water, like all other substances, will be of different weights under equal bulks, at different temperatures; and its apparent weight will be affected by the varying pressure of the atmosphere, as well as that of the weights employed, while their absolute gravity is that they would possess *in vacuo*. There appears at first sight to be a practical difficulty in this determination, in consequence of its being almost

impossible to ascertain with the necessary precision the interior dimensions of a vessel; but we have a remedy in the well-known physical fact, that a solid body loses, when weighed in a liquid, a portion of its weight of an equal bulk of the liquid; and the exterior dimensions of a regular solid are determinable within the requisite limits. But this experiment will be affected by the calorific expansion of the substance employed, and by the buoyancy of the air affecting its absolute weight. The law then must not only express the absolute weight (in vacuo) of a certain bulk of water in terms of the standard of weight, but must describe the temperature of the water, and the substance of which the weights and the experimental solid are to be made. It so happens, that in this case also we have a temperature, or rather a state of water, defined by a physical fact independent of instruments or extrinsic causes. Water does not follow the general rule of contraction; contracting to a certain limit, it again expands while cooling for several degrees above its freezing point. This fluid, therefore, has a maximum of density, and varies so slowly in bulk on each side of this maximum, as to afford room for the greatest accuracy of experiment.

Two methods exist of defining the magnitude of measures of capacity. The first and most obvious would be to prescribe the cubical dimensions of the unit in terms of the unit of length; but this is liable to the objection already stated, viz., the great difficulty of ascertaining with accuracy the internal dimensions of a vessel; the second consists in prescribing the weight of water that the measure shall hold, and this is in all respects preferable, but especially so from the very great ease with which the determination can be made. Here also it will be necessary to declare the atmospheric pressure and temperature at which the experiment shall be made, and this may be simply done by enacting that the water shall be at its maximum density, and pressure of the atmosphere at a mean.

(4.) The law of the province of New York of 1703, the act of 1784, and the revised law of 1813, recognise two standards of weight, without prescribing their relation to each other. Of these, the troy pound has long ceased to be used in any purely mercantile transaction, except in the retail trade of the apothecary; gold and silver are indeed also weighed by the troy pound: the former object is of very trifling importance, and the latter being governed by the practice of the mint of the United States, may be considered as a subject on which the national government has virtually legislated, and on which it would be improper for the state government to act. No other unit of weight then should be retained but the avoirdupois pound; and as the quintal of 112lbs. has been abolished in practice, no other denomination of that species of weight, except the usual binary subdivisions of the pound.

Did the original law of 1703, or the act of 1784, authorize two different units for liquid and dry measures of capacity, I should recommend the abolition of one of them as useless, and particularly from the confusion that arises from two different magnitudes being called by the same name. But it appears evident from the law of 1784, that but one measure is contemplated for both objects. The introduction of the British wine gallon is, therefore, unwarranted by the law of 1703, by the ancient practice of the province, or by the law of 1784, and has probably crept into the revised law of 1813, in consequence of its being used in the Customs of the United States: it is, therefore, consistent with the ancient law to prescribe but one standard for measures of capacity; but it might be expedient to permit the retail of articles paying duties to the United States in measures derived from the offices of the several surveyors of the Customs.

(5.) The act of 1784 adopts, as the standards of the state, certain weights and measures in the custody of William Hardenbrook, the sealer of the city and county of New York; and directs that he shall deliver them to the clerk of the city, in the presence of the mayor, recorder, and one or more aldermen, declaring upon oath that they are the identical articles received by him from the British exchequer. The importance of the object justified the solemnity of the manner pointed out for the transfer of these ancient and venerable standards of the province to the custody of the authorities of the state. But no corresponding means of preserving them were pointed out, and it is to be believed that they are no longer in existence; for a law of the 24th of March, 1809, adopts as the standard yard a brass measure, procured by the corporation of New York, in 1803, from the British exchequer; the liquid measures of capacity in the custody of the Secretary of State bear date in 1822, (at least nine years later than any existing law,) and the standards of dry measure are dated 1804. Now, as it has been found that the yard, purporting to be a copy of that described in the law of 1809, and deposited in the Street-commissioner's office, in this city, is shorter than the usual English yard of the beginning of the present century, which was itself shorter than the standard, as examined in 1760, and perpetuated by the celebrated *Bird*, and as we know of no adequate means employed in 1804 and 1822 to determine the truth of the new measures of capacity, I conceive I am warranted in stating that the original standards of weight and measure of this State, as they existed on the day of the declaration of its Independence, have been lost; and the present is one of those junctures that call for scientific investigations to recover such of the ancient denominations as it may be expedient to restore identically, and to deduce from them the others in the most unexceptionable manner. With a view to this object, I have already stated that I consider the parliamentary standard of 1760, as unquestionably identical

with the standard of our state as it existed at the Revolution, and that the experiments of Sabine, in Columbia College, have provided the facility, within our own state, of restoring the yard to its original magnitude. After the experiment shall have been made in this building, the measure should be transferred to some proper public edifice, the site at least of which may, in all succeeding ages, be resorted to, in order to confirm, or restore to their primitive dimension, existing weights and measures.

If, however, it should be preferred that the yard at present in the office of the Secretary of State should be the standard, it will be essential, in order to perpetuate it, to make similar experiments of comparison with the pendulum, one set of which should be made in this institution, as in this way alone its ratio to foreign measures (particularly to those of England) can be obtained. But I conceive this plan to be objectionable in several points of view, particularly as more difficult and expensive, and as adopting for a standard a measure whose authority is at least questionable. It would also prevent any positive legislation on the subject until after the experiments shall be made. The English avoirdupois pound, as a separate standard, appears to have been lost. So long since as 1798, Sir George Shuckburgh could find none in the public offices that could be considered as authentic,* and it has, therefore, been customary in England to deduce it from the troy pound, on the principle that it was equal to 7000 grs., of which the troy pound contained 5760. The experiments of Graham, in 1743, on weights of 15lbs., made the avoirdupois pound of which, at that time, authentic standards still remained, equal to 6998.5 grs. troy, while on the comparison of the single pound it was equal to 7004 grs.† The avoirdupois pound might, therefore, be fairly taken at 7000 grs. troy. But this is evidently of the customary weight as usually employed, and not of the pound discovered by Kater, in the custody of the clerk of the British House of Commons. Of the customary weight used in the mints of this country and England, the weight of Sir George Shuckburgh made by the celebrated Troughton may be considered as the most authentic specimen. Assuming the true magnitude of the avoirdupois pound to be 7000 grs. troy, the weight of a cubic foot of water, as calculated from the experiments of Shuckburgh, at its maximum of density, and weighed with brass weights, is 999 ounces and $\frac{67}{100}$, the measure of the experimental solid being performed upon a scale, whose standard temperature is 62° of Fahrenheit‡. The experiments of Shuckburgh have been recently repeated by Kater,¶ and from these I have calculated the weight of a cubic foot of water at its maximum of density to be 999 $\frac{32}{100}$

* Philosophical Transactions Abridged, vol. xviii.

† Philosophical Transactions Abridged, vol. xviii.

‡ Young's Natural Philosophy, vol. ii.

¶ Third Report to the British Parliament on weights and measures. Philosophical Transactions for 1821.

ounces, assuming the measure of the experimental solid to be made on a scale whose standard temperature is the melting point of ice: no danger then need be apprehended in taking the weight of a cubic foot of water at 1000 ounces avoirdupois, and prescribing that the legal weight shall be such as will give that determination.

The discrepancy between this and the present received weights (if accurate transcripts of the former British standards) will not exceed three-tenths of an ounce in a hundred pounds, a quantity absolutely insensible in the course of traffic, less than the difference in the current standards of the avoirdupois pound, in 1743, and far less than the amount of discrepancy discovered in the several States of the Union, as detailed in the able report of Mr. Adams.

For the unit of measures of capacity, I would propose the adoption of the gallon. It is sufficiently large to prevent any chance of error in the determination of the most usual denomination of dry measure (the bushel,) and it is itself the customary unit of liquid.

We shall now proceed to consider what ought to be the size of this unit. The Act of Parliament, of 13th William III. cap. 5. prescribes that the standard bushel shall contain 2150 inches. But among the standards preserved in the British Exchequer, for the bushel and its several parts, considerable discrepancies exist, and it would be difficult to determine from which of these the bushel of the Revolution was derived. Their several magnitudes are as follows:—

Bushel.	*Gallon.*
2215.2	276.9
2234.4	279.3
2163.2	274.4
2128.9	266.1
Mean 2185.4	272.5

Still greater discrepancies exist in the usual bushels of different parts of the United States, which vary in the two extremes from 1925 to 2358.6 inches, (giving the gallon the two dimensions of 241.25 and 294.8,) as stated in the report of Mr. Adams.

Instead, however, of prescribing the cubic contents of measures of capacity, it would, as has been already explained, be much better to determine their magnitude by declaring the number of pounds of distilled water at the maximum density and mean pressure of the atmosphere that the unit should contain. If this weight be taken at 80 lbs., the bushel will be 2214.36 cubic inches, and the gallon 276.8. These dimensions differ less from the standard now adopted in England of 2217.6 and 277.2 than either of the above dimensions do from each other.

This method has a great advantage over that of actual measurement, inasmuch as the weight can be determined with suffi-

cient accuracy, wherever good balances and just weights are to be had: while, to determine the cubic contents of a vessel is one of the most difficult operations of practical geometry, and is liable to such uncertainty, that in all recent investigations into the magnitude of measures, their weight when filled with distilled water has been resorted to in preference as the surest criterion.

It might, in this stage of the discussion, be asked, Why propose a system founded upon principles and facts requiring so much accuracy of determination and knowledge of science? And, Why not have recourse to England at once, and obtain thence their new standards?

To the first of these it may be replied, that the practical adjustment of weights and measures is always liable to certain errors; that these, in the lapse of years, where no checks are provided, would reach such an extent as wholly to obliterate the recollection of the original standards. The more strict then the provisions of the law, in respect to accuracy, the less will be the danger of error, from the discouragement it will give to rude and inartificial methods of comparison; and the more scientific the means of recovery and examination that are pointed out, the greater will be the certainty of perpetuating, or restoring, the standard in after-ages. As to a recurrence to England, a variety of reasons would oppose it, each of them valid and sufficient in itself: a proper feeling of national pride would forbid our asking aid of a foreign country, in a matter for which our own artists and men of science are competent. Economy also forbids it, as standards identical with those of the British government could only be obtained by sending out a competent person to superintend their construction, and compare them strictly with the originals. The articles vended in trade as accurate measures are not to be depended upon implicitly, and, however suitable to commerce, would be unfit for a national object; moreover, there are certain inaccuracies in the English law itself, which I cannot but believe must ere long require its revision in that country, and we should in that event obtain and bring into use a system differing from that which now exists among us, with every probability that it could not be permanent. Neither is it likely that any agent of our State, however fully authorized and accredited, could obtain all the necessary facilities.

The errors I allude to in the English law, which will be fatal to its own permanence, are—that the comparison with the pendulum which is used to define the unit of lineal dimension has been made in a private house, which cannot be reasonably considered as accessible for public purposes; that the length there determined has been assumed to be the universal length in the same parallel of latitude, while it has been conclusively proved that this length is influenced by local causes, a fact, that although not then absolutely demonstrated, was so far foreseen by the French commis-

sion, that they define, as the means of restoring the metrical system, if lost or impaired, not the pendulum of the latitude of Paris, but that of a specific place, the national observatory in that city; that the unit of weight (one nearly abandoned in this country) is derived from an experiment that requires a legal enactment to define and perpetuate an arbitrary thermometric scale, instead of taking, as is here proposed, a temperature defined by a physical fact, or law of nature, unsusceptible of modification or mistake under any circumstances; that the bulk of the water whose weight is given (a cubic inch) is much too small for accuracy; and that the unit of measures of capacity is deduced from that of weight, upon principles equally objectionable with those on which the latter is derived from the lineal measure. In addition, it is to be remarked, that the direct comparison and transfer of measures of length is hardly susceptible of accuracy equal to that obtained by means of the pendulum; that the system proposed, looking for its era to the date of the declaration of the independence of our State, would be exclusively and pre-eminently American. Another strong and important argument may be used: the city of New York possesses artists adequate to the construction of almost every part of the necessary apparatus; their skill and talent are now devoted to objects of inferior importance, that neither enhance their reputation nor add to the mechanical credit of the country: let them be employed upon an object of national, nay, universal, interest, and the name they will acquire will probably create a branch of commerce in similar articles, that will add much to the wealth and resources of the State. The importance of this argument was well understood by the French government, and such was the success of the attempt, that it transferred to France, for the supply of its own demands, a branch of manufacture that had previously carried large sums to Great Britain, and struck the first blow to the hitherto pre-eminent reputation of the articles of that country.

(6.) From what has already been stated, it will appear that I am not of opinion that the pendulum of lat. 45°, the northern boundary of our state, could be advantageously used, either as the unit of lineal measure, or as the standard existing in nature whence the unit of lineal measure is to be derived, and with it all other measures.

This, however, is a subject on which I venture to speak not without some hesitation; the authority of Mr. Jefferson is so high, both as a man of science and a statesman, that I do not differ from him without a feeling of extreme diffidence. Still, however, being satisfied that in the present state of knowledge, he would have concurred with me, and that the difference is one, not of opinion, but of existing facts, I do venture to differ from his views, stated as long ago as 1790.

I do not conceive that the pendulum of that latitude is to be

preferred before that of any other as a standard existing in nature, while, as the absolute unit of length, it must be rejected upon the ground of the impossibility of introducing it, in consequence of its discrepancy, and that of all its derivatives from the habitual measures of the country. The latitude of 45° appearing at the first view as the mean between that of the Equator and the Pole, might have been thought peculiarly advantageous. On this head it is to be observed, that it is a matter of question at the present moment between the governments of the United States and Great Britain, what this lat. of 45° is; are we to take for it the latitude determined by Astronomic observation at the surface of the earth, or the latitude corrected for ellipticity which is known by the appropriate name of Geocentric? And in connexion with the present subject, a third view of the question arises, for neither of these is distant from the Equator, the half of the itinerary distance between that circle and the Pole, but the point of bisection falls between them; which, then, of these three positions are we to choose for our experiments, particularly when the two best adapted, and between which the choice would most reasonably appear to fluctuate, are actually within the limits of possession of another nation? It is, besides, to be remarked, as has been before stated, that it is now well known that the length of the seconds pendulum does not depend upon the latitude merely, but is affected by the geological and mineral structure of the place where the experiment is performed, and its vicinity*. Neither is thependulum of 45°, even were the earth a sphere and the density of its surface uniform, the mean pendulum, for that would be found in the latitude of 35° 16′. For these reasons I cannot see any important advantage to be gained from naming the pendulum of 45° in the revision of the statutes relating to this subject.

For all immediate purposes, the inference drawn from the experiments of Sabine in this institution may be received as sufficient, and the liberal spirit of the trustees guarantees that the place of experiment will be accessible for the purpose of the first investigations, and the construction of the standards to be deposited in the proper public office. But it cannot be too strongly urged, that this measure should be transferred to a building, the property of the state, as early as possible, and that in it the instruments and documents connected with this investigation should be deposited. For this purpose, a location near the present seat of government, or perhaps one more central, in relation to the ultimate population of the state, should be chosen; and a preliminary law should provide for this important object.

(7.) The legislative provisions necessary to attain the objects of a well-regulated system of measures, and its recovery, in case of loss, would be most advantageously comprised in two different

* Sabine. Experiments on the Pendulum.

acts; one to become a permanent part of the revised laws—the other to be preliminary and temporary. The provisions of the first should be:—

1. That there shall be but one standard of measure of length and surface, one of weight, and one of measures of capacity, in this state.

2. That the unit of lineal measure shall be the yard, as used in this State at the date of the declaration of its independence, and that for its more precise definition, and in order to its recovery in case of loss, it is declared (until the measure of the pendulum shall be transferred to some appropriate public building), that the said yard has been found, by experiments made with a pendulum, with a brass rod, at Columbia College, New York, in the latitude of 40° 42′ 43″, to bear to the pendulum of that place vibrating seconds in vacuo, and at the level of the sea, at the temperature of melting ice, the proportion of one million (1,000,000) to one million, eighty-six thousand, one hundred, and fifty-eight (1,086,158).* That the yard shall be divided into three equal parts, called feet, and each foot into twelve equal parts, called inches, and shall be measured between two points, engraven upon golden disks, inserted into a brass rod.

This yard will be identical with that adopted in England, each being taken at its standard temperature, according to the principle of comparison pointed out by Wollaston, and used by Kater in his experiments on the measures of France. I am not fully satisfied that this principle is correct, being rather inclined to think that measures should be compared at a common temperature; but it is that which is now received in practice, and has, besides, certain conveniences as applied to this subject, in keeping the proposed system of weight and measures of capacity more near in magnitude to those received in England.

3. That the unit of weight shall be the pound of such magnitude, that the weight of a cubic foot of distilled water at its maximum density, weighed in vacuo with brass weights, shall be sixty-two and a half ($62\frac{1}{2}$) pounds, that the pound shall be divided into sixteen equal parts, called ounces, of which parts the cubic, foot of distilled water, under the same circumstances, shall weigh one thousand (1000) ounces.

4. The unit of measures of capacity, whether dry or liquid, shall be the gallon, which shall be a vessel of such capacity as to contain at the mean pressure of the atmosphere at the level of the sea, ten pounds of distilled water at its maximum density; that all other measures of capacity shall be deduced from the gallon by continual multiplication or division by the number 2, being in the descending scale, half-gallons, quarts, pints, half-pints, and gills; and in the ascending scale, pecks, half-bushels, and bushels. And that, for greater precision, the last, or measure of eight gal-

* The length of the said pendulum is 39.10158 inches.

lons, shall contain at the mean pressure of the atmosphere at the level of the sea, eighty pounds of distilled water at its maximum of density.

(*To be continued.*)

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN DECEMBER, 1833.

With Remarks and Exemplifications, by the Editor.

1. For a *Socket for Holding Awls and other Tools;* Herrick Aikin, Dracut, Middlesex county, Massachusetts, December 16.

This invention has undoubtedly received the sanction of ages, although the experience of practical workmen has not induced them to adopt it. A common awl handle has a ferule at the end, with a socket to receive the shank of an awl. This is the whole affair, and if the patentee had examined the *tool chests* which are prepared in Europe for the use of *gentlemen*, he would have seen, like many others, that he had been anticipated in his *discovery*. We could cite, also, two or three domestic patents for socket awl handles, but, so far as we can recollect, these had about them some new nicnackery which gave to them some claim to novelty, if not to utility. A workman always finds it better to lay out a penny for a handle to each awl, than to be obliged to change it from one to another.

2. For a *Machine for Tempering Clay;* Nathaniel Adams, Cornwall, Orange county, New York, December 16.

The tempering is to be effected by the usual mode of causing a wheel to revolve on a circular bed of clay; and the novelty, or supposed novelty, of the invention, is the construction of the wheel, and the causing it to roll upon the bed of clay, spirally, alternately approaching the vertical shaft in the centre, and the outside of the bed.

The wheel is to consist of several separate rims, with a space of an inch, or more, between each, the more perfectly to divide and temper the clay. In order to give it the spiral motion, the horizontal shaft, which is drawn round by the horse, is a square bar, having on it a sliding socket, which is round on the outside, that the wheel may revolve upon it. A toothed wheel on the vertical shaft in the centre, gives motion to a pinion which takes into a double rack, connected with the sliding socket, and moves the wheel in and out in the way required. This "contrivance, in combination with the wheel above described, constitutes the claim.

A machine very similar in its construction, and intended for the same purpose, was patented by Mr. O. W. Seely, of Wayne county, New York, on the 20th of July, 1831, and is described in vol. ix. p. 54. The revolving wheels, in that machine, were carried in and out by a screw upon the shaft, which was a more simple plan, and equally efficacious with the one now proposed: and each wheel in it was described as furnished with four rims, or sets of felloes.

3. For a machine for *Cleaning Clover Seed;* Leonard Keep, Tyrone, Perry county, Pennsylvania, December 16.

A circular trough is to be prepared, like that used for grinding bark and other purposes, and pieces of timber attached to arms from a vertical shaft, are to rub round in this trough. The bottom of the trough, as well as the ends of the rubbing pieces, are to be made rough, and the latter are to be so fixed as to be elastic. The upright shaft, which is to be turned by a horse, may, we are told, carry a fanning apparatus.

The description is very imperfect, and there is no claim made.

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4. For a *Bake Oven;* J. Swift Gold, Norwich, New London county, Connecticut, December 16.

This the patentee calls the Union Oven, but the reason for so naming it is not apparent. It is to be made much like the square sheet iron ovens, long used both here and in England, which have a space round them for heated air, and shelves within them to support the articles to be baked.

"The two distinct improvements claimed in this oven, and which are intended to be secured, are, first, the prevention of the loss of heat, by means of the confined air; and, second, the increased effect from the circulation of the heat and air within the oven." The circulation of heat is treated in the specification something like that of water under a given pressure, but we are unable to trace its action. The lower shelf is to be made double, in order to prevent the burning of articles placed upon it. The oven may be put over an ordinary fire, or fixed in other ways, and it may, also, be made in various forms.

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5. For a *Revolving Spinner,* to be used in spinning cotton, &c.; W. Allen Potter, Cranston, Providence county, Rhode Island, December 16.

This patent is taken for a new modification in the arrangement of the rings used instead of flyers in what has been called the ring spinner. The rings surrounding the bobbins are to have grooves on their outer edges, a light band carried by a horizontal pulley at the end of the frame being employed to drive them. This band is to be borne up against the rings by pairs of small friction rollers situated between each of the rings, and sustained on the same horizontal metallic plate which sustains them; the pins upon which these rollers turn, pass through slots in the plate, in order to increase, or to diminish, the pressure of the band upon the revolving rings, and, consequently, the strain upon the thread which passes over a hook or pin on each ring. The claim is to the arrangement and combination of the several parts described, and particularly to the construction of the rings.

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6. For an *Elevator, to be used in elevating Building Materials;* Charles G. Fairman, Lewiston, Niagara county, New York, December 16.

In this apparatus there is a frame, two of the upright posts of which must extend to the full height required for scaffolding; a cross beam connects these posts together at top, and supports two pulleys, over which ropes are to pass to raise one hod, or bucket, and to lower another. The ropes are to be acted upon by a windlass of the common construction, and which is attached to the lower part of the frame.

What there is new in this, excepting that the patentee exhibits in his drawing a neatly joined frame, tenoned and morticed together, we cannot tell; we have often seen bricks and mortar drawn up by ropes, operated on by a windlass, raising one vessel, and lowering another; but then the whole was unpatented, and there was no frame excepting that of the windlass; all the necessary apparatus being supported by the ordinary scaffolding of timbers, projecting from the building. Editors do not build; but were we able to do so, we would, if we pleased, raise our materials by a windlass and tackle, in spite of this and all other patents. We wish, however, that the patentee had vouchsafed to state his claim, that we might be in no danger of interfering even with the invisible part of his invention.

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7. For a *Medicated Shampoo Bath;* Richard D. Mott, Boston, Massachusetts; an alien, who has declared his intention of becoming a citizen of the United States, December 16.

This bath is said to be intended for "conveying into the human body the compounded medicinal virtues, and essential oils of herbs, by means of steam." The herbs are to be put into a tin case, perforated with holes, and the person is to be seated above this instrument, surrounded by a tent-like covering. A thermometer, flesh brush, and other suitable affairs are to be employed when necessary.

The patentee has not said a word about invention, and we will not pretend to decide that there is any thing new in any part of the process, or of the apparatus.

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8. For an improvement in the *Composition of, and mode of making Candles;* Philip Farrell, city of New York, December 16.

Twelve or fifteen pounds of white pine turpentine are to be mixed with one hundred pounds of melted tallow, the former being first boiled in water for two or three hours, to evaporate its oil, or spirits.

The discovery claimed is, the using of the above named composition, in lieu of tallow alone; and the improvement is in the comparative cheapness of the compound.

Would it not be better to take rosin at once in place of the turpentine? The boiling "for evaporating the oil or spirits," reduces it to the state of rosin, and wastes the spirits.

How new, or how old, this plan may be, we do not know, but have no doubt that were we to inquire among the negroes in the pine woods of North Carolina, we could find hundreds of them who have been in the habit of making a similar mixture.

9. For improvements in the *Puddling and Heating of Iron in the process of manufacturing it;* William Jones, Haverstraw, Rockland county, New York; an alien, who has resided two years in the United States, December 16.

We have rarely met with a patent for the full understanding of which a drawing was more necessary than that before us, as the invention consists in a furnace which is novel in its construction. It appears, however, that there is not either a model or a drawing of it in the patent office, notwithstanding the direct and positive requirements of the law, that the whole shall be accompanied "with drawings and written references whenever the nature of the case admits of drawings." If this omission would not be fatal in the present case, we know not where it would.

The improvement, we are told, consists of a stove, or heating apparatus, attached to, and connected with, a puddling furnace, which stove is to be heated by the fire that serves for working the furnace.

The furnace is to be divided into three compartments, communicating with each other. The coal, or fuel, apartment, the puddling apartment, and the stove or heating apartment, which is over the puddling apartment. The dimensions and construction of these several parts are described, with certain requisite arrangements, which require a drawing to make them clear. The flame from the fuel apartment is to be carried horizontally across the puddling apartment, and through a flue by which it is to reach the heating apartment. By this arrangement we are told "pig iron, refined metal, blooms, billets, bars, or other iron, cut into pieces about six inches in length by three inches diameter, is heated into nearly a melted state, and when so heated is conveyed through the aperture described, into the puddling apartment, and then wrought into balls, without the necessity of a fresh fire being put on."

The object of the inventor is, manifestly, to patent the peculiar construction of this furnace; he, however, has not told us so, but has left this to be inferred, as he has left the structure of his furnace to be imagined.

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10. For an improvement in his machine for *Cutting Straw, Hay, &c.*, patented March 9, 1833; James Luckey, city of New York, December 16.

In the machine as formerly patented by Mr. Luckey, the cutting knife was placed upon a plank, or frame, which vibrated horizontally below a vertical hopper; in the improvement now patented, knives are fixed upon a horizontal wheel, which is made to revolve, take the place of that first used.

We are informed that the invention now claimed "consists in the wheel of knives, as before described, for cutting straw, &c. whether these knives be attached to a circular rim of metal, &c. or be placed upon arms attached to the vertical axle, and loaded at their extremities, so as to act like a fly wheel, by increasing the momentum of the

machine; and doing away with the use of the crank and vibrating motion as in the former machine."

We noticed two machines in the last number, Nos. 27 and 58, in which the straw is placed in a vertical hopper, and the cutting effected by knives on a revolving cylinder beneath it.

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11. For a *Self-supplying Pen;* Charles Cleveland, Middlebury, Addison county, Vermont, December 16.

(It is intended to publish the specification of this patent in the next number.)

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12. For a *Method of forming and laying ropes by machinery;* George Bradley, Fishkill, Dutchess county, New York, December 16.

The description of the machinery here patented occupies a dozen pages of foolscap, referring throughout to a number of drawings, the whole being very clearly laid down. We can only give the claim, which is in the following words:—

"I claim that, as a combination, it is a new machine which has not heretofore been known or used. And I especially claim the invention of the revolving creel in which the bobbins of yarn are placed to be formed into the ready, and the revolving flanch, or circular guide plate, which twists and lays the thread in the ready before it passes the compressing tube; and the application of the machinery necessary for their support and motion as described. I specially claim also, the application of two shafts, or the insertion of one shaft into another, making thereby a compound shaft for the support of the combined wheel, (containing the three spindles,) which is susceptible of two quantities of motion, by which I give my spindle any desirable number of turns, while the ready, from them, is forming into rope. I also claim the invention of the shaft with the bevel gear and pulleys upon them upon the outer or forward end of the blank wheel, by which any inequality in the tension of the strands is regulated and equalized. And the arrangement of machinery by which the whole process of forming the ready, and laying the rope, is effected; and I claim them not only in the size and proportions as herein described, but for any size and proportions which may be useful in laying and making all kinds of cordage and ropes."

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13. For a *Cooking Stove;* Elisha Town, Montpelier, Washington county, Vermont, December 16.

The specification of this patent is not a description, as it merely tells what is claimed by the inventor; the drawing, however, which accompanies it, represents the stove clearly in one of its forms. The things claimed are, "First, the use of *cranes*, so constructed in the top as to be made the seats, or resting places, for pots, kettles, or other furniture in use about the stove, and by which they may be easily swung on or off the fire, thereby regulating the quantity of heat applied to them." These, so called, cranes, consist of a part of the upper

plate of the stone, with the requisite appurtenances, which swivel on a pin, allowing them, with the cooking utensil, to be drawn on one side. Second, the use of these plates between the oven and the fuel, to render the heat in the oven uniform. Third, the casting of a portion of the hearth, under the fuel, in a separate piece, to admit of its expansion and contraction. Fourth, a damper, or door, which is to slide up and down in front of the fire to regulate the draft, and to admit of toasting, &c. before it. Fifth, the general construction of the stove, admitting of the introduction of grates for the burning of coal, peat, or other fuel.

Sliding doors, to rise and fall in grooves, in the front of fires, are a very old contrivance, and this, at least, therefore, had better not have found a place among the things claimed as new.

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14. For a *Currying Knife;* John Glen and John Herd, Urbana, Champaign county, Ohio, December 16.

This knife is to be made of one piece of cast steel, and to be forged out without heating it above a blood red; it is then to be hardened by heating it slowly and regularly over a charcoal fire, using no blast but that of hand bellows; when hot enough to burn shavings, it is to be thrown into cold water, containing a pint of salt to every four gallons. It is to be tempered by placing it between plates of cast iron, heated so as to burn oil, and stout enough to retain the heat; the whole is to be gradually cooled together, when it is ready to be ground.

The whole process of manufacture is thus given, but without saying what in it is new; excepting that it is "made in a different way, and of a different composition from others, being entirely solid steel." Although curriers' knives are generally made of iron and steel combined, they have frequently been manufactured of cast steel exclusively; and as to the heating and tempering, there is in these nothing which we have not long known, and which, in its essential features, has not been practiced by workmen.

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15. For a *Seeding Cultivator;* John Richard, Guilford Township, Franklin county, Pennsylvania, December 16.

This is a modification of that species of harrow usually denominated a cultivator, and which, we are informed, operates well in practice. The frame of it is made triangular, each side being about seven feet long, and in drawing it along, one of the sides of the triangle becomes the forward part; two handles, like those of a plough, projecting from the hind angle. In this angle there is fixed a double, or wedge-formed mouldboard, provided with a share and coulter. This share and mouldboard project forward towards the front of the cultivator, and serve to divide the lands. In each of the side pieces of the frame there are ten teeth, each about four inches wide, and made in the usual form; they are placed so as to stand at right angles with the sides, and therefore, obliquely to the line of their motion.

"In using this instrument the ground is first prepared by ploughing

and harrowing in the usual way. When this has been done, and the seed sown, the land is staked off at distances of a little upwards of seven feet; the stakes serving as guides for the centre, or plough, part of the cultivator, and the teeth on the sides then form the ground into furrows of the most convenient and suitable width for the advantageous growth of the grain."

The claim is not to any of the individual parts, but to that general arrangement and combination of them which gives to this machine its individual character. "A principal feature by which it is thus distinguished, being the reversed direction in which the triangle is drawn forward; and the fixture of the double mouldboard and its appendages, by which the lands are divided."

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16. For an improvement in the *Construction of Spectacles;* Joseph Richards, city of New York, December 16.

There are to be springs in the temple joints of these spectacles, which, by their action, will keep the temple bows closed when the spectacles are not in use, and will clasp the temples with sufficient firmness when they are on. The temple joints may be small barrels, and the springs a few coils of a watch spring. When thus made, the second joint, it is said, may be dispensed with, and the whole be made lighter than spectacles usually are. "The only thing that the applicant claims, is, the application of the spring to the temple joints of spectacles."

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17. For an improvement in the *Hydrant;* Jacob Stroop, Allegheny, Allegheny county, Pennsylvania, December 16.

This apparatus is precisely the same in principle with that patented by Newton and Laning, on the 30th of July last. There are some nonessential differences in them in point of arrangement, but the conclusion is irresistible, that one is the offspring of the other; although which is the parent, and which the child, belongs not to us to determine, nor have we the means of doing so.

We have, in the present number, given the specification of that patented by Newton and Laning, with an engraving exhibiting the manner in which the waste water is made to retire from the pipe, into a reservoir provided for that purpose, and again made to fill the discharge pipe, by the descent of a plunger, when water is to be drawn. This is the essential feature of the apparatus; the distinguishing characteristic of the invention; and it was to this part that we alluded when we said that the machine now patented is the same with that of Newton and Laning.

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18. For a *Machine for Cutting Straw, Hay, Tobacco, &c.;* James Secor, Bristol, Bucks county, Pennsylvania, December 16.

The knife in this machine is fixed like that noticed in the patent of Mr. John Shaw, p. 323. The straw, &c. is to be contained in a trough, and advanced by feed rollers, a balance wheel on a crank shaft regulating the motion, and turning the feed rollers by a feed hand acting

upon a ratchet wheel. Instead of the fly wheel, we are told that a pendulum may be employed.

Although there is no novelty in any part of the machine, taken separately, and scarcely any in its combination, the patentee has found much to claim, as will appear from the following quotation.

"What I claim as my own invention is the application of the lever in the manner described; the application of the friction rollers, for the purpose described; the manner of using the feed rollers, with the vertical knife, and mode of operating them; the application of the balance wheel; the vertical cutter, and the application of a pendulum for a balance."

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19. For a *Water Wheel;* Isaac Van Gorder, Warren, Trumbull county, Ohio, December 16.

This is a wheel said to be acted upon by the percussion, gravitation, and reaction of the water applied to it. The wheel is to be contained in a chest or flume, in the manner of those called reaction wheels, but the water, instead of escaping from its periphery, as in most of them, escapes at the under side of it, supposing its axis to stand vertically. The wheel is to be solid in the centre, and may consist of a circular piece of timber, two feet in diameter, and eight inches thick; around the edge of this are to be placed the buckets, of which there may be about twenty, so curved that they shall deliver the water below as nearly as may be in a horizontal direction; they may be two inches and a half broad. This wheel is to run within a circular case, or curb, and the water is to be admitted on to the buckets through openings above them, inclined in a contrary direction to the curvature of the buckets, and corresponding with them in number.

The claims made are to the construction of such a wheel, to run in a curb, or cylinder, protected by a platform, or guard, from the weight, or pressure of the column of water employed, the manner of applying the water at the periphery, through shutes, or guides, placed in a projecting platform, within a flume; together with some other incidental appurtenances.

We do not perceive in what sense it can be said that the water in this wheel acts by *gravitation*, *percussion*, and *reaction;* we consider these as merely different names applied to particular modes of action, all derived from the same power, gravitation, and that there is no mode in which the effect of this power may be twice told. In the wheel itself, there is little or no novelty.

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20. For *Tanning Skins, or Hides;* George H. Richards, city of New York, December 16.

This improvement in tanning is said to consist in applying the tanning liquor to the prepared skins, by exhausting the air from the vessel which contains them, so that the liquid may be made to ooze through them by atmospheric pressure. Different, but analogous, modes of effecting this, are described in the specification; and a claim is then made to "the plan of exhausting the air from skins and hides,

and thus opening their pores, and while in that state applying the tanning liquor to them; and by this means, and also by means of atmospheric pressure causing the liquor speedily and thoroughly to penetrate the hide, or skin, in such manner as rapidly and effectually to bring it into leather."

The principle upon which the above process depends, has been long known, and extensively practiced. At p. 418, vol. x. there is an article upon this subject extracted from Babbage's Economy of Machinery and Manufactures, in which this procedure is explained. We could point to several other sources for similar information, and among them, to a patent obtained about two years since, by a citizen of New York, for a mode of exhausting vats by hydrostatic pressure, and upon which we made some animadversions.

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21. For a *Machine for Hulling and Polishing Rice;* John W. Walker, Madison, Morgan county, Georgia, December 16.

There are to be two circular rubbers, one of which is to be stationary, and the other to revolve. They are to be fixed in a suitable frame, with the axis of the rubbers horizontal. The rice is to be fed through an opening in the stationary rubber, which conducts it near to the centre of the two rubbers. Both these rubbers are to be covered with leather, and that which revolves is to have tacks, or points, driven into it, in any suitable number or direction. The claim is to the "lining the cylindrical rubbers with leather, and studding the revolving rubber with tacks, or nails, placed in a spiral, or other, direction, for carrying the rice to the outside, or rim, of the rubbers.

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22. For an improvement in the construction of the *Thrashing Machine;* Daniel A. Webster, city of New York, December 16.

The improvement claimed consists in the mode of "placing plain or fluted rollers of metal, or wood, as beaters on the cylinder of the common thrashing machine, having springs placed against the back of each beater, and in the manner of adjusting the cylinder."

The beaters may be four, or more, in number; they are to stand at the distance of about an inch and a half from the cylinder, and to have axes in their ends inserted into sliding pieces, borne out by springs, but permitting the beaters to approach the cylinder in a degree proportioned to the quantity of the material between them and the concave.

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23. For an improvement in the common *Gopher Plough;* Thomas Carter, Laurens District, South Carolina, December 16.

The improvement claimed consists in a blade or plate of iron, operating as the shovel plough, but so formed that, according to the statement of the patentee, it will throw all the clods and rough matter from the young corn that is ploughed with it; operating much in the manner of the hoe, and superseding, to a great extent, the use of that instrument.

The drawing does not very clearly exhibit the particular construction of this part, and the *model* is referred to for further information.

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24. For *Making Iron and Steel, by the use of anthracite coal;* F. W. Geissenhainer, city of New York, December 19.

The smelting of iron from the ore into pig, or cast iron; the carbonating and refining this into malleable iron; the combining iron in a metallic state with a greater quantity of carbon, if bar iron, for steel; if white pig, or cast iron, for a superior quality; are all to be effected under this patent, by means of anthracite coal.

The patentee states that he has discovered the true principle, heretofore unknown, of applying anthracite to the purpose of smelting, &c.; and we sincerely hope that he may find his theory, or rather his practice, correct. The conversion of iron into steel may, he says, be effected by stratifying the iron with small pieces, or dust, of anthracite, in a cementing furnace, or in suitable vessels; anthracite being also used for heating the materials.

The aptness of anthracite to fuse and run together in a moderately high temperature, the patentee denominates its *continuity*, and he claims to have discovered that this tendency is counteracted by a greatly increased temperature, which must be excited by applying in an appropriate blast furnace, a stream or portion of air, in such quantity, velocity, or density, as shall correspond with the excess of density, compactness, and continuity. Thus, if we suppose the density of charcoal, to the coke of bituminous coal, to be as two and a half to one; and of coke to anthracite, to be as two and a half to three and a half, the quantity, velocity, or density of the blast, must be in these proportions. "By this illustration," we are told that "the true principle and manner of smelting iron ore with anthracite coal is fully explained.

The claims are made under six distinct heads. First, the application of anthracite coal to the deoxidizing and carbonating of iron ore. Secondly, to the combining iron in a metallic state, with a greater quantity of carbon, if bar iron for steel; or if pig iron, to render it of a superior quality. Thirdly, the smelting or reducing iron so deoxidized and carbonated, by anthracite coal. Fourthly, the refining cast into bar iron, by the same material. Fifthly, the applying of the blast upon the principle specified, for the smelting of iron ore. Sixthly, the applying heated air to the purpose of smelting; not to the fact itself as a discovery, but to the using heated air in conjunction, or combination, with the process, or principle, of procedure, explained in the specification.

We have thus given a general epitome of this specification; but think that the instrument itself is deficient in those practical details which are requisite to enable any one to follow the process described. It leaves an impression upon the mind that they have not been fully carried out by the patentee, or that he is not anxious to enable others to do so. This remark does not apply to the general principle of the

increase of the blast, although we think the defect pervades most of the operations alluded to.

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25. For an improvement in the mode of *Generating Steam;* Isaiah Jennings, city of Philadelphia, December 19.
(See specification.)

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26. For an improvement on the *Plough* patented by Mr. Barnard; Peter Hastings, Dogsboro', Sussex county, Delaware, December 19.

The improvement made "consists in casting the movable share and landside sufficiently deep to protect the front of the mouldboard from most of the wear to which it is exposed by his [Barnard's] plan."

We do not think it worth while to give the particulars, or to inquire whether the present patentee has acquired the right to the plough which he claims to have improved; this is a question that does not concern us, but it may concern some of our readers to know that they have no more right to another man's machine, because they may have improved it, than they would have to a neighbour's house because they had painted his door, or mended his window.

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27. For a *Plough;* Joseph P. Sharp, Geneseo, Livingston county, New York, December 20.

The points which are here considered as constituting the improvements, are, the particular form given to the mouldboard; the manner of fastening this and the other parts together, and of attaching the handles to the plough.

The former is illustrated by diagrams, but the latter are merely described, without being exhibited by drawings; and in this respect, therefore, the law is not complied with. As regards the form of the mouldboard, we are apprehensive that there are in the numerous variations of this part, some made either by accident, or by design, which would come very near to that claimed, and in practice operate like it. The particular curves and angles upon which its form depends, may also be departed from, and an instrument produced which, although in effect similar, would still not be embraced by the description before us, which is confined to minute particulars.

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28. For a *Machine for Hulling Cotton Seed, and Rice, and Grinding the Hulled Kernel;* Noel Mixon, Madison, Morgan county, Georgia, December 20.

On looking at the drawing accompanying this specification, we thought that we had, by mistake, obtained that belonging to the machine No. 21, which is from the same place, and for a similar purpose; they, in fact, do not appear to be mere neighbours, but absolutely twin brothers. In the present case, however, the leather is omitted, but the stationary and revolving disks, the spikes, and the

feeding, are identical. There is no claim made, nor are we informed in what way the machine is to grind the kernel.

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29. For an improvement in the *Grist Mill;* Adna Norcross, Hallowell, Kennebeck county, Maine, December 23.

One stone is to be made concave, like a bowl, and the other convex, to fit into it; this latter has a shaft through it, fixed horizontally on a frame, the concave stone being, of course, placed on its edge; and an opening is made in the upper side of it, through which to feed the grain.

Such mills have been made and patented before.

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30. For a *Truss;* James M'Chesney, city of New York, December 23.

The claims to improvement in this truss are "to the packing and unpacking, and fastening the rupture pad at pleasure, and to the fastening and fixing the ball in the socket."

The front, or rupture pad, is covered with leather, which is fastened round a ring, forming the periphery of the pad. There is a back plate screwed on to this ring, by small screws, and when these are removed the pad may be packed so as to give it the desired form. The spring is attached to the centre of this plate by a ball and socket, which may either play loosely, or be fixed in any required position, by screws passing through the socket, and bearing upon the ball.

The drawings are good, but there are no written references to them, as by law required.

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31. For an economical mode of *Applying Water Power;* Timothy P. Anderson, Hardwick, Worcester county, Massachusetts, December 23.

The water is to be conducted through a close trough, or spout, from the lower side of a flume, so as to surround the water wheel. This wheel stands on the lower end of a vertical shaft, and consists of six leaves, or buckets, formed like those of a smoke jack, having openings of about two inches, and lapping over each other so as to deliver the water in a direction nearly horizontal. The end of the spout which surrounds the wheel, is to decrease in height in its circuit, and this, it is strangely enough imagined, will influence the pressure of the water on the wheel. If the wheel was placed in an opening in the bottom of the flume, it would be more simple and equally efficient, but still it would *not* "make a valuable saving of water," as the patentee believes his will.

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32. For a machine for *Dressing Woollen Cloths and Sattinetts;* Stephen R. Packhurst, Mendon, Worcester county, Massachusetts, December 23.

The claim made in this machine is to the combination of the several parts described in the specification, by which, among other advan-

tages, will be that of the saving much of the labour and expense which are encountered in the process usually followed. We are informed that when it is used, "The cloth may be taken from the fulling, or rinsing, mill, and stretched, made smooth for napping, napped, steamed, and dried ready for shearing, by simply passing it through the machine, thereby saving its being passed through several hands, and operations, to accomplish the same purpose."

There are to be six principal rollers mounted in a frame, and moved by proper gearing; two of them, called the winding rollers, are to receive the piece so that it may be alternately wound from one to the other; in doing which it is passed through two pair of rollers, which are pressed together by suitable means. Above the cloth, and between the pairs of main rollers, are placed two napping cylinders, covered with card teeth, or teazles; these do not touch the cloth, excepting when it is borne up against them by an apparatus acting upon it for that purpose. There is attached to the machine a stove, or heating apparatus, the main flue, or body, of which is placed below the cloth, in such a manner that the water which is squeezed out of it by the rollers, shall fall upon the surface of said stove, and be thus converted into steam; which, it is said, will, in most cases, be sufficient for the steaming of the cloth.

It will be seen by those acquainted with the dressing of cloth, that there is nothing new in the principles involved in the application of this machine, and the claim is, therefore, very properly confined to the particular combination and arrangement of its various parts, so that the whole, or any required number of the operations, may be simultaneously performed.

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33. For a *Horse Power;* Benjamin D. Beecher, Cheshire, New Haven county, Connecticut, December 23.

The shaft to which the horse is geared is made conical, the base of the cone being at the outer end, towards the horse, where it is supported upon a circular rail-way, on which it rolls as the horse moves round. A bevel wheel on its smaller end, near the centre of the circle, gives motion to a train of wheels which drive a horizontal shaft, placed in a trough under the horse walk. The claim is to the "rolling shaft, or wheel, on a smooth surface, and the manner of constructing and operating the machine."

A patent has been previously obtained for machinery operating in the same way; but as we do not believe that the right is worth disputing about, we shall not at present take the time to examine into its date; said patent, however, was granted about two years ago.

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34. For *Applying the Power of Horses, or other Animals, to propel Machinery;* John and Luke Hale, Hollis, Hillsborough county, New Hampshire, December 24.

The horse is to stand upon an inclined revolving platform, constructed of plank in the usual way; around the rollers which sustain this floor, endless chains pass, and form a part of its support. These

are very obscurely described, and not at all represented in the drawing, which is also without "written references." The claim is to "the manner of supporting the platform," which, for aught we know, may be very good.

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35. For an improvement in the mode of *Removing the refuse Bark from the Leaches used in Tanning;* Harvey W. Babcock, Cooperstown, Otsego county, New York, December 24.

"The improvement claimed, and for which letters patent are petitioned, is the right of emptying the refuse bark from the leaches used in tanning, by means of plugs, valves, or sliding gates, in the bottom, sides, or ends, by water let in at the top, sides, or ends, as the situation of the leaches, and the water will admit."

There are but few tan vats, or leaches, so situated as to allow of the bark being thus washed out; the mode of doing this, however, where it is admissible, is so obvious, as to render it highly probable that it has been before known and used.

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36. For a *Machine for Sawing Marble, Stone, or Wood;* Charles B. Austin, Kensington, Philadelphia county, Pennsylvania, December 24.

An endless belt of metal is to pass round drums upon revolving shafts. When stone is to be sawed, the metal belt may be of iron, copper, or other suitable metal, the edges being smooth, and supplied with sand and water as the stone is moved up against it by a suitable carriage. When wood is to be sawed, the belt must be of steel, and toothed. It is proposed, also, to punch holes through the belt, to receive corresponding pins upon the drums, and thus to prevent slipping.

Under the article *Sawing*, in Rees' Cyclopedia, it is mentioned that a patent had been obtained for sawing by "an endless steel band, or blade, extended over two wheels placed at a distance asunder, just like the endless straps which are used to communicate motion from one wheel to another." And, in the same article, that there was "invented by one Misson, inspector of the marble quarries in the Pyrennes, a kind of long saws, by means of which stones are sawed, even in the rock itself; some of them were made twenty-three feet long; but neither their form or application is described; it being only said that they were of iron, and without teeth."

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37. For an improvement in the *Still;* Elias Herr, Lampeter T. S., Lancaster county, Pennsylvania, December 24.

The improvement in the still consists in extending the neck to the height of six or eight feet, gradually tapering from the top of the still to the bend where it leads off to the refrigerator.

Stills with high necks are no novelties, but have often been prescribed and used when it has been desired to draw off high wines at a single operation. "The doubler is placed in a tub, or box, sur-

rounded with sand, which being heated by the doubler retains the heat, and assists in the operation." This sand heat is equally new with the long neck; and as these are the only things mentioned, we infer that it is intended to claim them, although nothing is said upon this subject.

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38. For a machine for *Cleaning Clover Seed;* George Hassinger, William Stees, and William Kuhn, Union county, Pennsylvania, December 24.

This machine is to be formed much like that noticed in No. 28, for hulling rice, &c., and we might add, like a great many others. Two circular disks, or rubbers, are to be placed vertically in a suitable frame, one of them to revolve, the other to be stationary; for a few inches from the periphery they are to be flat, and thence to the centre a little concave. The seed is to be fed in through the stationary disk, just above its centre; the disks may be of stone, metal, or wood, but in the latter case, they are to be covered with punched iron, or rendered rough in any other suitable way. If we admit the evidence of the patentees, "This differs from all other machines, in its operation and application."

The science which investigates the operations of the human mind is equally interesting and difficult; the objects of its inquiry are neither ocular nor tangible; nor is it presented with those images which render mathematical investigations demonstrative; such being the case, it is not surprising that we should be at some loss in perceiving how three minds have concurred in elaborating this machine for the rubbing out of clover seed; such, however, appears to be the fact, the thing being verified under oath.

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39. For a *Machine for Cleaning Clover Seed;* Christian Landes, Mount Sidney, Augusta county, Virginia, December 24.

There are to be four, or any other convenient number of rollers, of suitable size and length, placed near to each other, their gudgeons resting upon a frame which forms an inclined plane. The rollers are to have teeth in them, so placed that in revolving they will not interfere with each other; and below them are to be concave beds, also furnished with teeth; a cover placed over the whole, prevents the escape of the seed.

The feeding is to be effected by an endless, revolving apron, and the seed and hulls are to be received upon a vibrating riddle. The invention is said to consist in "the peculiar arrangement of the several parts of the above described machine for hulling clover seed; particularly the arrangement of the rollers and beds filled with pins, or points; the cover over the rollers, and the vibrating screen."

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40. For an improvement in the *Ridging Plough;* William Atwood, and Daniel Hamblett, Cornish, Sullivan county, New Hampshire, December 24.

The share of this plough is to be made "in the Dutch form," so fitted as to turn the furrow right and left. It is to have a bar across from wing to wing of the share, through which a bolt passes up through the beam. The wood also, is to be "in the Dutch form," but is to have a left hand mouldboard added, and the handles are to be fastened to the mouldboards; it is then ready to ridge land for summer tilling.

There is a drawing of the plough, but it is without references; and the specification is without a claim; our principal information respecting it, therefore, is, that there is much that is Dutch about it; whilst what we desire most to learn is, how much of it may be claimed as American; not that we are any more disposed than the patentee to think lightly of the Dutch part, which he certainly would not have adopted had he not found it good.

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41. For an improvement in the cast iron *Plough;* Anthony Taylor, Green Township, Columbia county, Ohio, December 26.

The improvements that are claimed in this plough, consist in the form given to certain parts, and the manner of putting them together. The coulter is to form a part of the share, instead of being made in a separate piece. The horizontal surface of the mouldboard, instead of being straight, is to be "nearly spherical," to facilitate the breaking of the turf. The mouldboard is to be continued up to the beam, so as to form a bolt passing through it, having a shoulder to fix it firmly. There is to be no concavity between the angle of the share and coulter and the rear point, on the front side of the mouldboard, which enables it to enter the ground as an inclined plane. "All the above specified improvements I allege to be of my own invention;" an allegation, by the way, the truth of which admits of some doubt.

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42. For an *Anthracite Coal Burner;* James L. Alney, Providence, Providence county, Rhode Island, December 26.

Although the patentee has taken much pains to describe his stove, and has furnished a very good drawing with written references; and has, moreover, informed us in what his claims consist, we are at a loss in selecting for our readers the points of novelty. It may be sometimes judicious, where there is little that is novel, to admit of some obscurity; as in that case the imagination is left free to act, and may come in to the aid of the inventor.

The stove is to be of cast iron, and we are furnished with two views of it, one in the Grecian, and the other in the Gothic style of architecture. There is a top vessel for containing water, and on removing this, fuel may be supplied to the *chamber of combustion*, forming the base of a pyramidal, or conical, stove body, the lower part of which is lined with fire clay.

The following is an abstract of the advantages offered by this stove, as set forth by the patentee. They consist "chiefly, in having the chamber of combustion lined with fire clay, by which the caloric is retained, or distributed in the most economical manner. Whilst the

upper chamber being of cast iron only, suffers the heat to pass quickly through it to warm the room. Besides, the nonconducting, or clay, lining at the bottom of the chamber of combustion, enables you to preserve fire in a very small quantity, if necessary, and for a very long time." These are most undoubtedly real advantages, as has been fully proved ever since anthracite coal has been introduced as an article of general consumption; what these observations, therefore, may lack in originality, they must be allowed to make up in truth.

The claims are to "the peculiar construction of the anthracite coal burners, and their several parts as before described; and particularly *the lining of the chamber of combustion with fire clay*, so as to retain or to distribute the caloric or heat with the greatest economy; also the manner of fitting the door, or blower, to make part of the hearth when turned down."

The part italicised has been so distinguished by us.

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43. For a *Scrubbing Machine;* Thomas Rickey, Greenfield, Highland county, Ohio, December 26.

We have looked very carefully through the papers of this patent to learn what was intended to be scrubbed by the aid of this new machine, but have not succeeded in our researches; as floors, however, are the most frequent subjects of this process, we infer that these are the things to be acted upon by it; although, judging from the drawing and description, the apparatus is rather a formidable one for this purpose. The description is very obscure; but the drawing represents a sort of box, having a scrubbing cylinder placed across it at the angle formed by one end and the bottom of it. This cylinder is to be about two feet long, and five inches in diameter, "said roller to have husks fastened round it for the purpose of scrubbing." Motion is to be given to it by a wheel and band, from a band wheel: above the cylinder is a box to contain "scrubbing materials," with small holes in the bottom of it to allow them to drip through upon the cylinder; and behind it there is an endless apron passing round two rollers, one above the other, the lower one keeping the cloth in contact with the floor, that it may wipe up after the scrubber. A scraper, or something of that kind, is to take the water and dirt from the apron, and conduct it into a box. Whether the machine is to be moved by steam or horse power is not told us; we predict, however, that after it has been once tried, it will share the fate of the various perpetual motion machines, and come to a stand still.

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44. For a machine for *Making Rivets, Heading Wood Screws, and for cutting and punching metals;* Enoch Scott, Rochester, Monroe county, New York, December 26.

This is a machine, the parts of which are fixed in a strong iron frame; the cutting, punching, and heading apparatus being worked backward and forward by motion communicated from a crank shaft, to a stout iron lever; and by cams, &c. where required. The machine

is well represented in the drawing, although the description is but an indifferent one, and neglects altogether to inform us what is new in the machine; and as similar operations are performed by analogous means in other machines, we are left at a complete loss on this point; in fact, we see nothing that could have been claimed excepting the particular combination and arrangement of the parts.

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45. For a method of *Hanging House Bells;* Seth Fuller, city of Boston, Massachusetts, December 26.

"The improvements particularly claimed are, the construction of the *box* to inclose the bell,—the substitution of the stationary clock bell for the common house bell, and the application of the *box, cylinder, lever, friction roller, staple, clock bell, crooked spring hammer, springs, wires, strings, and vibrating plate,* to produce a sound and motion so definite and distinct as to draw the attention of those interested, to the proper point, without unnecessary noise, waste of room, or injury to the appearance of the room where the bells may be placed."

The bell, as will be perceived, is to be the common hemispherical clock bell, which is to be struck by a hammer; two strokes being given by the tipping of the hammer by a lever which passes backward and forward when pulled. A tin plate suspended by a wire from the lower part of the lever, has a number marked upon it, and by its vibrations indicates which bell has been struck.

The box, and various other things described and claimed, are not represented in the drawings as they ought to have been to fulfil the intention and requirements of the law; and although the specification is drawn up with care, it is deficient in clearness, not conveying to the reader the ideas existing in the mind of the writer; this defect would have been remedied by proper drawings.

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46. For a *Machine for Breaking Corn;* Webber Furbish. First patented March 15, 1833. Patent surrendered and reissued, December 26.

We noticed the former patent in due course; the claim now made is to "the employment of indented and plain rollers, or of indented rollers, or of indented rollers and a suitable concave segment, so arranged, upon the principle, or in the manner set forth, as to form a machine to be employed for the breaking, or cracking, of corn."

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47. For improved *Metallic Pumps;* Jedediah Beckwith, Saratoga, Saratoga county, New York, December 27.

When patents are obtained for pumps, we rarely look for novelty in the things claimed, and if the patentee had, in the case before us, claimed any thing, he would not have presented an exception to this rule; he, however, has merely given us references to the drawing, which represents two chambers, with their pistons moved by a rack and pinion, the handle being a pendulum attached to the pinion.

48. For a piece of furniture called a *Stand;* Ezra Riply, city of Schenectady, New York, December 27.

This "*Stand*" is to be like other stands in form, but not in material, as, instead of wood, it is to be made of cast iron, or other metal. The one represented in the drawing, is a tripod, with a rim at the top suitable for a wash hand bowl, but they are to be of any required form. The principal advantage stated, is the ornamental embellishments, in the manner of carving, &c., which such a stand may receive at little cost, and its light appearance with great strength.

We have seen cast iron tripods, much like the one drawn, placed on the blocking of a portico, to hold a lamp, and if this patent is good, should the owner carry one of these in doors, and use it as a wash-hand stand, he must buy a right. We have also seen metallic "stands, or tables," imported from France, usually of brass, and neatly ornamented. Independently of all this, however, we should very much doubt the validity of a patent for a mere change of material.

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49. For *Setting Kettles for Boiling Sugar;* Joshua Jordan, city of Boston, Massachusetts, December 27.

The patentee calls his contrivance "the damper sugar furnace," and states that it comprises "an improvement in the mode of constructing sugar furnaces and setting kettles for manufacturing sugar, so as to prevent the sugar from burning during the operation of striking, or removing the same from the granulating kettles to the coolers, and for other purposes therewith connected." The principal object in view, however, is the preventing of the burning of the sugar in striking.

In constructing the furnace, the fire is made to pass directly under, and through a flue around the granulating kettle, before it reaches that for evaporating, so that, by means of the damper, it can be prevented from acting on the granulating, without interfering with its operation on the evaporating and clarifying kettles, while the striking is going on.

Between the bottom of the granulating kettle, and the fire, a damper of a peculiar construction is to be introduced during the striking. This damper is a vessel of copper, made flat in the form of an oblong square, of sufficient width and length to cover the fire, and hollow so as to contain water in the cavity formed between its flat sides, which water cannot escape excepting through a safety tube, extending up from its outer end. Above the furnace door, there is another close to the bottom of the kettle, and of such size that when open, the damper can be passed through the opening. This damper is placed upon a carriage, which runs upon a rail-way, in front of the furnace, and when wanted it is brought up, and slid in through the opening, from off the carriage; the same serving to remove it when it is no longer wanted.

Another damper, similarly constructed, is placed vertically between the granulating and evaporating kettles. When this is down in its place, the fire passes freely through a suitable opening in it for

that purpose, but when raised, by the aid of pulleys, the opening between the two kettles is closed by an imperforated part of the damper.

There are in the drawing a number of the parts of the furnace represented, which are without written references; the general plan, however, is sufficiently apparent, although no specific claim is made.

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50. For a *Machine for Dressing Staves;* Ebenezer Gregg, Derry, Rockingham county, New Hampshire, December 27.

This machine contains circular saws for cutting the staves to a length; a heavy wheel with cutters on its periphery for dressing the hollow side of the stave; an apparatus for receiving it afterwards, dressing the opposite side, and jointing it, all of which, taken together, has an appearance of much complexity; it, however, is well represented in a drawing, to which there are numerous and full references, and in these its description principally consists.

The claims made are to "the application of the balance wheel with cutters; the flyers with concave edges, and the particular manner in which the rolls are placed and regulated; the application of the saws for cutting off the ends, and jointing the staves; the form of the racks, the swing box, and other apparatus regulating and guiding the saws; the particular manner in which the saws are applied for the purposes set forth, and operating in the way described."

It may be doubted whether some of the particulars claimed can be sustained as original, although, as combined together, and forming the machine described, they may legitimately constitute a new invention.

[TO BE CONTINUED.]

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improved Hydrant, in which the water is prevented from freezing in winter, and the waste pipe is altogether dispensed with. Granted to THOMAS W. NEWTON *and* JOSEPH H. LANING, *city of Philadelphia, July* 30, 1833.

Attached to the end of the pipe that draws or conducts the water, is a large hollow male screw, the calibre, or hole, through the screw to be about the same, and attached so as to correspond with that of the pipe. There is a small cylinder, or chamber, attached to the male screw, the calibre of which, where it joins the screw, and for a small distance up, is to be from a half inch, or more, larger than the calibre of pipe and screw to form a chamber suitable for the spiral spring and valve; the valve seat is formed by bringing the calibre again to that of the pipe.

The calibre of the cylinder, or chamber, immediately above the valve seat, is to be two, three, four, or more inches in diameter, for a piston, or plunger, to work in, and to draw the water down out of the hydrant low enough to prevent its freezing in cold weather. The piston, or plunger, is raised to draw the water down out of the

pipe, with a rod attached to it, and to one end of a small lever working on a fulcrum, with a weight on the opposite end. The valve is opened by a small rod, or pin, in the valve, or piston, or plunger, when the piston, or plunger, is caused to descend by raising the lever; and closes by the force of the spiral spring and the water, when the piston, or plunger, is allowed to raise again by the action of the lever, and the weight on the opposite end.

If it should be found necessary, or more convenient, there may be two long staples linked together, and attached one to the valve, the other to the piston, so that when the piston, or plunger, descends, they will open the valve at the proper time, and when it ascends they will close the valve more securely, and prevent the piston, or plunger, from ascending more than necessary for the purpose of drawing the water down out of the hydrant, or discharging itself.

We claim as our invention, or discovery, the above described mode of constructing, combining, and applying to the use of hydrants, for the purposes described and intended, the hollow cylinder, or chamber, piston or plunger, lever, spiral spring, and valve, without regard to proportion or size, as that may be varied according to circumstances and places.

THOMAS W. NEWTON,
J. H. LANING.

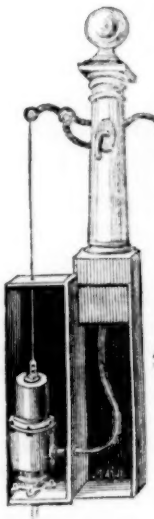

Fig. 1.

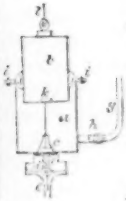

Fig. 2.

Fig. 1. Hydrant in the ground.

Fig. 2, Cylinder to contain the waste water.

a, Cylinder to contain waste water.
b, Plunger.
c, Valve.
d, Spiral spring.
e, Service pipe.
f, Leather washer for valve to work against.
g, Draw pipe.
h, Coupling box to connect draw pipe to cylinder.
i i, Flanch to press packing to cylinder.
j j, Hemp packing.
k, Nut on valve stem.
l, Connecting rod.

Specification of a patent for an improvement in the mode of generating steam in steam engine and other boilers. Granted to ISAIAH JENNINGS, *of the city of Philadelphia, December* 19, 1833.

To all whom it may concern, be it known, that I, Isaiah Jennings, of the city of Philadelphia, have made an improvement in the mode of generating steam, in steam engine and other boilers, by which improvement both economy and safety are attained; and that the following is a full and exact description thereof:—

I make use of such boilers as are generally employed, my improvement not being in any way dependent on the particular form thereof, but upon the manner in which such boilers are filled, or charged with water, in combination with other substances. My invention principally consists in the placing within a boiler spongy, porous, or solid substances of various kinds, so as to fill, or nearly to fill, its internal cavity, with the exception of the spaces between, or within, such substances. As, for example, I prepare globular, or irregular lumps, of wood, of such diameter as may be found convenient, say from three inches to one foot, or more, in diameter; or, instead of balls, I use pipes, or round sticks of wood, perforated with holes; which sticks, or pipes, are to be piled within, and along the boiler, until it is filled, or nearly so. Instead of wood I sometimes employ reeds, canes, or stalks of various kinds; taking care, however, that the substance be such as will not be readily reduced to pulp by boiling in water. I sometimes prevent the vegetable or other substances so placed within the boiler from coming in direct contact therewith, leaving a cavity all around them, to be occupied by water, which may be done in various ways. Let there, for example, be cylindrical boilers, in which this is to be done; I make a cylindrical vessel of wood, cut and fixed together like the staves of a barrel; this cylinder may be three or four inches less in diameter than the interior of the boiler; it should be perforated with holes, and is to have spikes, or pins, driven into it, over its outside, extending out, so as to bear against the sides of the boiler; this will leave a space as above mentioned, of from one inch and a half to two inches, more or less, between the wood and the metal. The wooden cylinder is to be filled with blocks of wood, or other materials, in the way already described.

For steam boilers used on land, where an increased weight is not objectionable, I sometimes use more solid materials than wood; such, for example, as large pebble stones, which, although they do not possess all the advantages of porous substances, yet, from their durability, will, in many cases, be preferred.

The increased surface obtained by thus charging the boilers, especially when the softer and more porous woods are employed, occasions a great increase in the production of steam, exceeding, it is believed, that which can be safely obtained by any other arrangement where the actual quantity of water within the boiler is so small as in that above described. For filling with water, I use such supply

pumps, or other means, as are already known; and add a steam chamber, or such other appendages as may be found convenient.

What I claim as my invention, and for which I ask a patent, is the placing within boilers of the ordinary construction, materials such as I have described, or others calculated to produce a similar result, which shall occupy the larger portion of the capacity of such boilers, whilst sufficient space is left between the touching points of, and the cavities within, such substances to contain the quantity of water which may be requisite for the generation of steam.

ISAIAH JENNINGS.

ENGLISH PATENTS.

Specification of a patent granted to CHRISTOPHER P. BANCKS, *Brass Founder, for an improvement in the Manufacture of certain culinary and chemical utensils and vessels. Dated June* 29, 1833.

To all to whom these presents shall come, &c. &c. Now know ye, that in compliance with the said proviso, I, the said Christopher P. Bancks, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the following description thereof, that is to say:

My improvement in the manufacture of certain culinary and chemical utensils and vessels, consists in protecting or strengthening such vessels, when made or formed of zinc, and are intended for utensils or vessels of capacity, and to be submitted to the action of fire in boiling liquids; or to be used for any other similar purpose where they are likely to be injured by heat. And my improvement in strengthening and protecting such vessels, consists in casing or covering them, either wholly or partially, with thin sheet copper, iron, tin plate, brass, either soldered or riveted to the vessels, and which I perform in several different ways; that which I most prefer for vessels of small capacity I shall first describe.

I make or construct a shell or outer casing from thin sheet copper, iron, tin plate, brass, or other thin sheet metals, of the proper size and shape required, either by hammering, stamping, or raising, or by uniting the sides and bottom by riveting, soldering, or otherwise; I then cover the inside of this shell or outer casing, with tin, in the ordinary manner of tinning; I then place into the tinned shell or case a core, suspended or placed in such a way as to leave a small space all round it, between the surface of the core, and the inside of the case or shell, the width of the space being of the thickness of metal required to form the inner vessel; I then run or cast into the space, zinc, in a state of fusion, which fluid zinc will melt or fuse the tin on the inside of the case or shell, and cause it to act as a solder between the zinc and the shell, or casing, and cause the two to adhere firmly together; and after the zinc has become cold and hard, the case is removed, and the inside of the vessel turned to produce a smooth sur-

face, in the usual way, and then the handles, spouts, or other outer parts may be attached by rivets in the ordinary manner. In some instances, I have found it desirable to alloy the zinc with a small portion of tin, say ten per cent., by which the zinc is made closer in grain, and does not contract so much in cooling, and may be worked with greater facility; but the same will melt at a proportionably less temperature. When constructing vessels of larger capacity, the contraction of the thick body of zinc in cooling, would cause it to be drawn away from the inside of the case or shell; I therefore, when constructing such vessels, cast the zinc into the proper shape required, separate from the shell or outer case; and after preparing its outer surface by turning, I cover it with a coat of tin, and then place it into the shell also previously tinned on the inside, both the vessel and the shell being made hot enough to fuse the tin, which, on cooling, will cause them to adhere firmly together: or, instead of casting the vessels separate from the shell, I sometimes construct them out of rolled sheet zinc, and unite the parts by solder or otherwise, and then tin the outside, and place them within the case or shell as above described. My intention in thus strengthening or protecting vessels of capacity, when made of zinc is to prevent the melting or burning of the vessels at the parts where the handles or spouts are attached to them, which has hitherto been the case in vessels made of zinc, and has therefore prevented their use in common; I therefore sometimes make my improved vessels with only a broad hoop of thin sheet copper, or other metal casing, placed round the upper part of such vessel, and unite it to the zinc by tinning or soldering, or by rivets, as may be thought best, as shown by the figure drawn in the margin of these presents, which is a view of an ordinary shaped stewing pan, *a* being the zinc vessel, and *b* the rim of sheet copper or other metal, which hoop of copper or other thin sheet metal (which will not melt but at a considerably greater degree of heat than the zinc vessel,) will sufficiently protect the zinc vessel, and prevent it melting at the parts near the handle, unless submitted to a greater degree of heat than necessary; and after these hoops are connected to the vessels, I attach the handles, spouts, &c. to the vessel by rivets passed through both the zinc and the thin metal, in the ordinary manner.

Having now described the nature of my invention, and the manner in which it is to be performed, I wish it to be understood, that I do not mean or intend to claim as my invention, any of the parts which are old, or have been before used, or any of the parts separately; and I would observe, that I am aware that efforts have been made to use zinc in washing the inner surfaces of vessels, in like manner to tinning; I therefore lay no claim to such using of zinc, but I do claim as my invention, as an improvement in the manufacturing of culinary and chemical utensils and vessels, the strengthening and protecting the inner vessels by the outer casing, in the manner above described, when such vessels are formed of zinc, as above described. I verily

believe that this my specification does, in all and every respect, comply with the proviso contained in the above in part recited patent.

[*Rep. Pat. Inv.*

Specification of a patent granted to JOHN SYLVESTER, *Engineer, for certain improvements in apparatus for raising the temperature of air to warm and ventilate buildings. Dated June 5*, 1832.

To all to whom these presents shall come, &c. &c. Now know ye, that in compliance with the aforesaid proviso, I, the said John Sylvester, do hereby declare, that the nature of my said invention of certain improvements in apparatus for raising the temperature of air to warm and ventilate buildings, and the manner in which the same is to be carried into effect, are clearly set forth and explained in the following description, that is to say.

The first part of my said invention applies to a grate in which the fire is made nearly or quite on a level with the floor or hearth; under which grate I make an excavation for the twofold purpose of an ash-pit, and of supplying fresh air to the bottom of the fire; and I place the fire bars of this grate with their back ends resting upon the back brim of the ash pit. Each bar lies separate from the other, leaving the usual space for the ashes to fall through, and for the air to pass up into the fire; and from the front part of each fire bar, I make a prolongation of sufficient length to bear upon, and lie over some portion of the common hearth. Each prolongation is increased in width from the fireplace outwards, so much, that all the prolongations taken together, shall form one continuous plate or metal hearth in front of the fireplace, nearly or quite level with the floor, as may be convenient: and I make along the underside of each prolongation of the fire bars, a groove or furrow, which, by laying on its bearing, will form a tubular perforation for the admission of fresh air to the ash pit and thence to the fire; and for the emission of warm air into the room.

The outward or front line of the metal hearth, or the line which bounds the ends of all the prolongations, may be either straight or curved, and the fire bars, with their prolongations, may lodge in a curb of stone or metal, at direction. And in order the more readily to open the ash pit to remove the ashes, I leave four or more bars unfastened, except by their weight, and which may be taken out at pleasure.

And I do further declare that the second part of my said improvement consists in attaching to the sides or back, or to the sides and back of my fire grate, and extending as high as may be convenient, or the situation will permit, a vessel, or vessels, for holding water to be heated by the fire; and I apply near to the outsides of the said vessel, or vessels, the system of tubes used in the apparatus known by the name of the "Derby Hot Air Stove," and described in a work published in London in the year 1819, entitled, "The Philosophy of Domestic Economy, as exemplified in warming, ventilating, washing, drying and Cooking in the Derbyshire general infirmary; by Charles

Sylvester, Engineer:" pp. 11 and 18; the essential principles of which stove is, that currents of air are made to pass through a considerable number of tubes of about two or three inches diameter, and to impinge upon the outer surface of a heated cockle, the delivering orifices of the tubes being placed at about half an inch or three quarters of an inch from the heated surface of the cockle, in order to deliver the air with certainty and force against it, and carry off the heat. And in my improvement I cause currents of air to be directed through tubes similarly placed, but make the air impinge against the outside of my vessel, or vessels, of heated water, by which arrangement a more equable temperature may be kept up with much less care and labour in attending to the fire.

The proportionate quantity of area of all the tubes, to the cubic contents of the apartment, or apartments, to be warmed and ventilated, admits of considerable latitude, according to the aspect of the room, or the influence it is under from the heat or cold of contiguous apartments, or from the external air. The dimensions of the fire grate, as also of the vessels of water, must obviously depend upon the size of the apartment, or apartments to be warmed and ventilated, and upon the degree of heat to be raised.

And whenever it is desirable to keep up a large fire in the grate, for transmitting the heat copiously to distant apartments, without giving out too much heat to the room in which the grate is fixed, I form a cover to fit over and in front of the fire, having a doorway through which fuel may be supplied, and thus I constitute my fire grate into an air furnace, for the more ready heating of my water vessel or vessels.

And I do further declare that I lay no claim to the exclusive use of the tubes above mentioned, nor to any particular form of grate or of water vessel, but only to the invention of forming and placing of the fire bars with their furrowed prolongations, as before described, and to the bringing of currents of air through the tubes of the Derby hot air stove against the side of a vessel, or vessels, of heated water, instead of against the sides of a cockle heated immediately by the fire.

[*Ibid.*

Specification of a patent granted to WILLIAM RHODES, *Brickmaker, for an improved manufacture of Bricks for building purposes. Dated February* 14, 1833.

To all to whom these presents shall come, &c. &c.—Now know ye, that in compliance with the said proviso, I, the said William Rhodes do hereby declare the nature of my said invention to consist in manufacturing bricks, the earth of which has been soiled with pulverised coke. And in further compliance with the said proviso, I, the said William Rhodes, do hereby describe the manner in which my said invention is to be performed, by the following statement thereof, reference being had to the figures on the margin of these presents, that is to say:—

I proceed in the usual mode, to manufacture my bricks until I arrive at that process called in the trade, soiling the earth, and then, instead of soiling it with ashes, or what is called London soil, small coal, or a mixture of these substances, or, as has sometimes been done, with a mixture of coke ashes with London soil (the coke ashes not being pulverized, and bearing but a small proportion to the other ashes or other soil,) I soil my brick earth with finely pulverized coke, only in the proportion of one inch and three-quarters depth of pulverized coke over one foot depth of solid brick earth.

In order the better to explain the nature of my said improvement, it may be as well to state, that the finest sieves now in use for sifting the soil, are composed of wire meshes of the size shown at fig. 1, on the margin; whereas I use sieves composed of wire meshes of the size shown at fig. 2,* on the margin; the consequence of which, and the use of pulverized coke, is, that I avoid the internal honeycomb appearance of the ordinary brick when broken. I pulverize the coke which I use either by crushing the large pure coke between rollers and sifting it, or else by sifting coke breeze and using the fine particles that sift out of the breeze, or I bruise and break the coke, or breeze, by hand, and then sift it, and I prefer that none be used to soil the brick earth with but such as is fine enough to pass through a sieve of the fineness of that shown on the margin at fig. 2, though coarser will answer the purpose, but not so well; in fact, the finer it is the better, and it may be as well here to observe that in order to use the said sieve No. 2 to advantage, it and the coke should be kept as dry as possible, for which purpose I usually hang the sieves in damp weather before fires to heat and dry, and keep the coke under cover.

Now whereas, I claim as my invention, soiling the brick earth used in making bricks for building purposes either wholly with pulverized coke, obtained in manner aforesaid, or otherwise, or with pulverized coke mixed with other firing. And such my invention being, to the best of my knowledge and belief, entirely new, and never before used within that part of his said Majesty's United Kingdom of Great Britain and Ireland, called England, his said dominion of Wales, or Town of Berwick-upon-Tweed, I do hereby declare this to be my specification of the same, and that I do verily believe that this my said specification doth comply in all respects fully and without reserve or disguise, with the proviso in the said herein before in part recited letters patent contained, wherefore I do hereby claim to maintain exclusive right and privilege to my said invention.

[*Ibid.*

* The drawing in the margin of the specification shows the sieve fig. 1 to be composed of oblong meshes of about three-sixteenths of an inch by two inches long, and the sieve fig. 2 is composed of meshes about one-eighth of an inch square.

Specification of the patent granted to MOSES POOLE, *for improvements in apparatus used for certain processes of extracting molasses or sirop from sugar; in behalf of a foreigner resident abroad. Dated June* 29, 1830.

To all to whom these presents shall come, &c. &c.—Now know ye, that in compliance with the said proviso, I, the said Moses Poole, do hereby declare, that the nature of the said invention, and the manner in which the same is to be performed, are particularly described and ascertained by the following description thereof, that is to say—

The invention consists in the application of an exhaustion vessel, or exhaustion vessels, to be exhausted in the manner hereinafter described, to those processes of extracting molasses, or sirop, from sugar, whereby the air is made to press upon and rush through the sugar with great force and rapidity towards the vacuum, and thereby cause the molasses, or sirop, to be exhausted, or drawn, therefrom, the vacuum, or exhaustion in such vessels being produced by the condensation of steam, or by a Torricellian column. I would here observe, that the principle of applying a vacuum for the purpose of causing the liquid to be separated from the concrete matter, is well known, and consists of an open vessel with a partition near the bottom, and thus forming a compartment at the lower part of the vessel from which the air is exhausted by means of a pump, the partition being perforated with small holes, and covered with a cloth of silk or other material, upon which the matter to be operated upon is placed, and the atmosphere continuing its weight upon the surface of such matter, so long as the space below the partition is in an exhausted state, and by such pressure the liquid part is pressed through the perforated partition. But in order that the invention for which the patent has been obtained may be more clearly understood and carried into effect, I will proceed to describe the apparatus constructed according to the invention.

An open vessel, which may be called the separating vessel, is to be constructed, having a partition, or false bottom, within four inches of the bottom, which partition, or false bottom, is to be perforated with small holes throughout its surface; and on the top of such partition is to be spread a cloth of horse hair finely woven, brass wire, or other material. The sugar to be operated on is to be placed on the cloth which is to be spread over the perforated partition, or false bottom, to the depth of three or four inches; the bottom of this vessel is to be concave inwards, in order that the molasses, or sirop, may run towards a cock which is placed there for the purpose of drawing off the molasses. Should the sugar operated on not part freely with the molasses, it is to be damped with water or any other liquid, and by this means the sugar may be brought to any degree of clearness. If I wish to operate upon Muscovado sugar, as it now comes home cured in the usual way, that is, the molasses partly separated from it by allowing it to drain slowly away, as is at present the practice in the colonies, then I add water or sirop in sufficient quantity, and con-

tinue the operation until the required degree of fineness is obtained. Now, in place of using a pump, or pumps, for the purpose of exhausting the lower part of the separating vessel, the object of the present invention is to construct a spherical or other shaped vessel, of copper or iron, or other material; one of about six cubic feet capacity is a good size, but it may be increased or diminished *ad libitum*. This vessel I call the exhaustion vessel, which is to be connected to the lower compartment of the separating vessel already described, by a pipe, having a stop cock placed upon it; at the top part of the exhaustion vessel is placed a cock, opening outwards to permit of the air being driven out; and at the lower part of the exhaustion vessel there is placed a cock for drawing off the condensing water.

Now, in order to set the apparatus above described in operation, sugar is to be spread over the partition, or false bottom of the separating vessel, to the depth of three or four inches, and steam is to be permitted to flow from a boiler, by means of a connecting pipe having a stop cock upon it, into the exhaustion vessel, which will drive out the air; when this is effected, the air cock must be stopped; the exhaustion vessel having become full of steam, the cock on the steam pipe is to be closed, and the cock, placed on what may be called the condensing water pipe, is to be open: this condensing water pipe leads from a reservoir of water placed above the apparatus; the part of the pipe which is on the inside of the exhaustion vessel, has a rose head attached to it, for the purpose of distributing the water into minute jets, so as the more readily to condense the steam contained in the exhaustion vessel, and thus produce a vacuum therein.

The state or extent of the vacuum may be ascertained at all times by having a mercurial guage or barometer placed in any part of the exhaustion vessel; when the steam has been condensed, the cock on the condensing water pipe is to be closed, and the cock on the pipe which connects the exhaustion vessel with the separating vessel, is to be opened, and the result will be, that the air will press upon and rush through the sugar with great force and rapidity in the exhaustion vessel, and will thereby carry down the molasses, or sirop, into the lower part of the separating vessel.

Now it will be evident from the above description, that this apparatus may be made in any sizes, to suit the various places wherein it is to be put up. The manner in which I prefer to construct the apparatus, is, to have two or more exhaustion vessels, so that whilst one is acting on the separating vessel, a vacuum may be formed in the other, and thus a continued succession may be kept in action on the separating vessel. I will now proceed to describe the manner of constructing the apparatus when a Torricellian column is made use of for the purpose of obtaining a vacuum; in this case the exhaustion vessel, or vessels, are constructed similarly to those above described, but in place of a steam pipe, a water supply pipe, with a stop cock, or valve, upon it, must be used: the condensing water pipe in this case will not be necessary, neither will the cock, placed at the bottom of the exhaustion vessel for drawing off the condensing water, be required; but the air escape cock, or valve, and the connecting pipe

between the exhaustion vessel and the separating must be retained. To the bottom of the exhaustion vessel, a pipe, descending about thirty-three feet, and communicating with a reservoir, is fixed, having a stop cock, or valve, placed upon it. In order to set this apparatus to work, the cock on the pipe which connects the exhaustion vessel with the separating vessel, and the cock, or valve, which is on the descending pipe, must be kept closed; the exhaustion vessel is to be filled with water by the water supply pipe, and the air in the exhaustion vessel will then be driven out at the cock, or valve, placed at the top of such vessel for that purpose. The cock, or valve, on the water supply pump, and the air escape cock, or valve, are to be closed, and that on the descending pipe is to be opened, when the water contained in the exhaustion vessel will subside to the height at which the atmosphere will support a column of water in a vacuum, and the exhaustion vessel which is above that height, will be left in a state of vacuum or exhaustion; then the cock on the pipe which connects the exhaustion vessel with the separating vessel, is to be opened, by which the atmosphere will be brought to press on the surface of the sugar, and as before described. In this case, two or more exhaustion vessels may be made use of in succession; but it will not be necessary to have more than one descending pipe; but each of the vessels must have a stop cock, or valve, on the branch pipe which connects it to the descending pipe.

Now I would have it understood, that, although I have here described parts of apparatus which are well known and in use, I lay no claim to them separately; but what I claim as the invention is, the application of the exhaustion vessel, or vessels, the vacuum in which is obtained by the condensation of steam, or by a Torricellian column, when used for the purpose of extracting molasses, or sirop, from sugar as above described. [*Ibid.*

Notice of Ericsson's Caloric Engine.

The January number of the "Repertory of Patent Inventions," published in London, contains the following review of an unpublished pamphlet, written by Mr. Ericsson, and intended to explain the nature and operation of his newly patented engine, which is to be actuated by heated air. An application is now before Congress for a special act directing a patent to issue to Mr. Ericsson, and our Consul at Liverpool, Mr. Ogden, conjointly, it being stated that the machine, as specified, is their joint invention. The applicants are gentlemen who are both known to the scientific world, and under any circumstances an instrument which in their opinion is likely to supersede the steam engine, would be deserving of special attention; and, certainly, it is not the less so in the present instance because it is likely to be presented to the American public, and under the sanction of a patent from the United States.

We have seen the specification, which has been referred to a committee of Congress, but are not at liberty in the present stage of the business, to publish any remarks respecting it, with the exception of

those which have appeared in England, where Mr. Ericsson has obtained a patent. Should the patent be granted in this country, it will then come regularly under our examination.

EDITOR.

The Caloric Engine. By J. ERICSSON. An unpublished pamphlet.

It has become a common practice with individuals, when they have secured their inventions by patents, to publish a book, or a pamphlet setting forth the merits and principles of their inventions. The system may be said to be a good one—for too much publicity cannot be given to a valuable invention, nor too much reward be obtained by the inventor, so long as that reward is a part only of the savings which are produced to the country by the application of any new means of manufacture, or of any better means of actuating the machinery which produces manufactures; whilst, on the other hand, the extensive publication of a supposed valuable invention, will more quickly produce inquiry into its construction; its value will be tested, and its want of merit will bring it quickly into oblivion.

From the time that Watt succeeded in maturing the steam engine, one common desire appears to have been felt by a particular class of individuals, to strike into a new course of experiment; feeling, we suppose, that the steam engine no longer offered the possibility of obtaining so brilliant a reward as a *power* produced by different elements. Consequently, the propositions for producing *motive power* are more numerous than any other class of projects; and from this source many inventions of value may be expected, though probably very many more failures. The invention now before us, has for its object, the superseding the use of steam, by substituting expanding atmospheric air.

Since we have undertaken the editing of the Repertory, we have avoided making critical remarks on any of the numerous inventions which come before us; and it is only when called upon to step out of our usual course, by the receipt of a pamphlet, as in the present instance, or by some cause equally moving, that we are willing to place our opinion before the scientific world, in respect to any invention; and although we have been invited to this subject several times by our readers, owing to the Caloric Engine having made considerable noise in the world, we have withheld our opinion, being desirous to obtain the fullest information on the subject, and not to depend on the mere reading of the specification for forming our judgment. The application of expanded air for producing motive power is not in itself a new proposition, neither does Captain Ericsson put forward any such claim; on the contrary, many experimental engines of this description have before been made, and Capt. Ericsson was himself, some years ago, interested in one that was erected, we believe, near the docks,* which was, at the time, said to be likely to supersede all other means of producing power, and induced Dr. Arnott, when writing his second volume on Natural Philosophy, to express

* By Count De Rosen.

himself most strongly in favour of expanding air for producing power in place of employing steam. This had before been a favourite subject with the Doctor, he having obtained a patent for an air engine. In his work he devoted many pages to prove that any given quantity of fuel used to expand atmospheric air, would produce four times the quantity of power as if applied to convert water into steam; and yet these engines passed away, without bringing into being others of the same family.

The present engine may be readily described; it consists of two cylinders, one being termed the *hot air or working cylinder*, which is fourteen inches diameter* the other being called the *cold air cylinder*, which is ten and a quarter inches diameter; each having a stroke of eighteen inches. These two cylinders are constructed similar to the cylinders of a steam engine, having induction and eduction ways, with ordinary slides for reversing the passage of the air to and from the two sides of the pistons. Each cylinder has an ordinary piston and a piston rod, which, by being affixed to either end of a beam, will be actuated simultaneously, the hot air cylinder by the expansion of the air, and the cold air cylinder by the action of the other end of the beam; the cold air cylinder performing the office of withdrawing the air from a vessel called the "regenerator," to make room for the hot air from one side of the piston of the hot air cylinder, when it has performed its office, and then forcing a quantity of air through the furnace to become heated to act on the other side of the piston in the hot air cylinder; the cylinders being double acting, the two operations are simultaneous. But thus far there is no claim of invention; the point of novelty is in placing a refrigerator between the hot air cylinder and the cold air cylinder, which the inventor has called the "regenerator;" it consists of an outer cylinder, or vessel, between seven and eight feet long, and eight inches in diameter. This vessel contains seven pipes, two inches in diameter. The long cylindrical vessel is divided into three parts, that is, the two ends are divided off by partitions through which the seven internal pipes pass, and thus open a way between the two ends of the regenerator; it will thus be evident that any air passing into one end of the regenerator will pass through into the other end of the regenerator by the internal pipes; but such air cannot get to the body or main part of the regenerator, till it has passed through the hot air cylinder. The cold air cylinder is connected, by means of a pipe, to one end of the regenerator, and another pipe from the other end of the regenerator, is connected with a series of small tubes, which pass over a furnace, and open into the induction pipe, of the hot air cylinder; the eduction pipe from this hot air cylinder opening into the body of the regenerator, in such manner that the hot air, after having performed its duty of actuating the piston, is intended to give off its heat to the air which is being driven through the internal pipes towards the fire. It should be stated that in order to prevent the hot

* We give the dimensions because the calculations hereafter given have reference to them.

air at once passing to the full extent of the regenerator, there are partial partitions which cause the air to take a circuitous, zig-zag course. From the other end of the regenerator, a pipe connects the outer vessel with the cold air cylinder; such pipe first passing through water to give off any heat which the air may contain when it arrives at this stage, so that it may pass into the cold air cylinder as cool as possible. The inventor also proposes that the seven pipes contained in the regenerator should also have partial division plates, alternately above and below, to cause the air continually to change its direction.

We believe the inventor will do us the credit to say that we have fairly described the nature of his combination. We will now permit him to speak for himself in describing the action of the machinery. He commences by stating that

"The leading feature of this engine, and which distinguishes the same from all other machines hitherto constructed for the purpose of obtaining mechanical power by the agency of heat, consists in this, that the heat which is required to give motion to the engine at the commencement, is returned by a peculiar process of transfer, and thereby made to act over and over again, instead of being, as in the steam engine, thrown into a condenser, or into the atmosphere as so much waste fuel.

"The well known phenomenon, that temperature, or quantity, of heat, is always equalized between substances, however unequal they may be in density, forms the basis of this new application of heat. But, previous to entering into the details of the caloric engine, it will be proper to give due consideration to its important aim, viz. that of producing a given quantity of mechanical force by a quantity of fuel so small, as to form only a fraction of that which has been stated by eminent experimentalists as the minimum.

"Several experiments which have been made tend to prove, and it is pretty generally acknowledged as a fact, that a given quantity of heat imparted to any gaseous body, will produce an equal quantity of mechanical force by the dilatation which it causes. And the most accurate experiments prove, that the combustion of one pound of the best coal is only capable of raising the temperature of 9000 lbs. of water one degree.

"On these grounds, the author of the best treatise on the steam engine has ventured to assert, that 'we have little to expect in the form of improvement;'* and he shows, by a set of tables, that an engine employed, for instance, in giving motion to the shaft of a mill, will consume from seven and a half to eight pounds of fuel in the hour for every horse's power constantly imparted to that shaft.

"In thus predicting limits to any further improvement, due consideration was, no doubt, given to the fact, that the heat which gives motion to a steam engine is still in active existence after having performed its duty in the cylinder; but the importance of that fact was probably passed over, because the heat imparted to the condensing

* See Tredgold's Treatise on the Steam Engine, p. 118.

water, although in *quantity* the same as previous to causing the motion of the piston, its *quality* is altered, viz. brought to a lower temperature, and thereby unfit for being carried back to the boiler to assist in raising a fresh supply of steam. But this circumstance of the heat being continually transmitted to the condensing water in the steam engine, proves its principle to be a direct misapplication of heat in producing mechanical force."

We would remind the author that many of the Cornwall steam engines are constantly raising from sixty to eighty millions of pounds one foot high by the consumption of every bushel of coals; if, therefore, he expects to supersede the steam engine, he must be able to show that his "caloric engine" is capable of performing more than the Cornwall steam engines with the same expenditure of fuel. We must confess that we do not understand what the writer means by the "*quality*" of the heat in steam being altered. If he means that some part of the heat has been taken up by the condensing water, we should understand him; but this cannot be fully expressive of his meaning, for he goes on to say, that the heat is "*unfit* for being carried back to the boiler to assist in raising a fresh supply of steam." Now we have always understood that the larger the quantity of heat which is contained in the water pumped back into the boiler, the less fuel is required to convert it again into steam; besides the condensed steam is pure water, containing no earthy matters, and is the most desirable to be used over again. However, it is not necessary that the inventor of an air engine should be thoroughly acquainted with applying heat to produce steam; but he ought to have it strongly impressed upon his mind that by withdrawing heat from steam in the condenser, a vacuum is produced behind the piston, and this advantageous effect cannot be produced when using air; neither can the volume of air be readily lessened when once expanded; it must, therefore, be an obstruction to the power on the other side of the piston—but more of this anon. To proceed with our extract—

"By reflecting on the nature of heat, it will become evident that there is nothing in its properties to prevent a given quantity once generated, or excited, from producing a continuous, and but slightly diminishing force by its dilating influence; for, if fluids contained in a vessel divided by a metallic partition, with a passage at each end, be heated towards one extremity, and then put into motion in contrary directions, their particles will, merely by the transfer of the same heat through that metallic position, successively repel each other with greater force as they appraoch the heated extremity, and with gradually less force as they approach the cold extremity of the vessel; or, in other words, the fluids made to circulate will continually dilate when at one end, and contract when at the other end of the vessel. By the caloric engine, consisting of a peculiar combination of pistons and valves, this constant dilation and contraction is employed for giving motion and power to machinery, without requiring any other additional supply of heat or fuel than what will make up for losses caused by radiation, and for the loss of heat which is occasioned by the circumstance that substances which are in a com-

pressed state have not so great a capacity for heat as when they are less dense."

The writer appears to have forgotten a very well understood property in pneumatics—that is, atmospheric air, when contained in a closed vessel, if pressed on at any one point, will instantly equalize that pressure in every direction, so that one part of the air will not remain more dense than another, and we suspect a very similar result will be found to take place in the "caloric engine."

[TO BE CONTINUED.]

¶ *On Machines for Parting Combs. By* W. ROGERS.

[From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.]

Materials for combs are—1, boxwood,—2, ivory,—3, horn; and, 4, tortoiseshell.

These being cut into pieces of the proper size, and the general form of the comb having been given to them by common tools, such as rasps, scrapers, &c. the next, and most important part of the process, is cutting the teeth.

This was formerly done, in all cases, by means of a double saw, consisting of two parallel blades, one of them being deeper than the other, so that when the deepest blade has cut to the whole depth of a tooth, the other shall have cut only to the depth of half a tooth. In using it, the deep blade makes the first cut at a little distance from the outside of the material, so that by the first action of the saw the outer side of one tooth and half the inner side of the same tooth are cut. The saw is then advanced one tooth, so that the deep saw rests in the cut made by the shallow saw, while this latter is ready to form half the outside cut of the second tooth. Thus the saw is advanced a tooth at a time, the intervals between the teeth are rendered equal, and half the cut for the deep saw being already made, the tool is prevented from swerving, or cutting teeth of unequal thickness.

Soon after the invention of the circular saw it was applied to comb cutting, by fixing on one axis two circular saws, one of greater diameter than the other, and regulating the distance between them according to the fineness of the teeth to be cut. Both the straight and circular double saws are now in use, the former being still applied to cutting combs out of all the four above mentioned materials, the latter being used chiefly for combs of box and of ivory.

Box wood and ivory, if subjected to the perpendicular action of a cutter would break and splinter; but horn and tortoise shell, being of a laminated texture, and capable of being rendered soft and flexible by heat, will yield in this state to the action of a sharp vertical cutter without splintering.

About twenty years ago, the principal house in London at that time for the sale of combs, had received from abroad some patterns of ornaments like the spikes and balls of coronets, to be attached to the tortoise shell combs.

They gave the order to execute these to an ingenious artist of the name of Ricketts, who contrived a punch, by the successive pressure of which on a thin piece of warm tortoise shell, he cut out the pattern, piece by piece. On disengaging the pattern from the other part, he observed to himself, "here are two combs cut out of the material for only one."

Improving on this hint, he soon contrived a machine in which a single cutter descended vertically, being put in motion by a treadle and wheel: the bed on which the tortoise shell was fastened was notched at the side, and these notches fitted into, and corresponded with, those of a rack placed parallel with it. After every cut the bed was moved forward by hand the distance of a single notch, and thus an equal interval between all the cuts was secured. But the form of the tooth of a comb being that of a very long triangle, it was necessary that, as the bed was shifted forward notch by notch, there should also be an alternate motion given to the bed: this likewise was given by hand; and thus the first rude machine for parting combs, that is, for cutting one set of teeth out of the intervals of another set, was completed.

When the knowledge of this machine began to spread abroad, various contrivances were invented to advance the bed, and give the necessary alternate change in direction, by machinery. In some cases, this alternation was given to the bed, in some to the cutter tself.

Previous to this time, however, it had occurred to the original inventor, Mr. Ricketts, that the machinery necessary to produce this alternation of direction might be dispensed with by making the cutter double, that is, composed of two blades set obliquely, so as nearly to touch at one end, and at the other to be as far apart as the width of a tooth, at the same time the blades made a return at their ends to liberate the extremities of the teeth.

It is evident that, while the cut is making, the material must be stationary, and that in the interval between the rise and descent of the cutter the bed must have advanced the breadth of a tooth. This was effected in Mr. Ricketts' double cutter machines by working the cutter alone by a treadle, and advancing the bed by a screw, to the end of which a winch was fastened, so that one complete, or one half turn, gave the necessary advance, a pause being made after each turn or half turn, to bring the bed to a stop while the cutter was in action.

Mr. Roger's machine obtains this end without the use of a treadle, by means of a single winch. The axis to which the winch is fixed gives motion to the cutter by means of a crank, and on the axis is a wheel having part of the cogs removed; this wheel takes into a common cog wheel on the axis of a screw, by the turning of which the bed with the work on it is moved forwards. Hence it is evident, that while the machinery for raising and lowering the cutter is in constant action as long as the winch is turned, the screw, which gives motion to the bed, is still, and out of action, during that part of the revolution of the winch in which the cogs of the two wheels are not bearing on each other. By enlarging the space from which the cogs of

the second wheel are cut away, the interval between one tooth and another is diminished; so that any given distance of teeth may be obtained by putting on to the axis of the screw, a wheel with the proper number of cogs.

The machines for parting combs, in all their modifications, have this advantage, of cutting two set of teeth out of the same quantity of material as with the common saw, is sufficient only for one set.

But every scale of tortoise shell is wedge-shaped at the margin, and therefore it is only to the thick pieces cut out of the middle part of the scale that this new invention can readily apply, for the wedge-shaped margin is not thick enough for the back of a comb. But, on the whole, the advantage as regards tortoise shell is very great, for the prime cost of rough shell of fine quality is four guineas per pound —a price greater than that of silver.

In many cases, however, the thin edges of a piece of tortoise shell may be strengthened by soldering it to a thicker or larger piece for a back. This is done by heating the shell and pressing it at the same time; but much care is required lest the shell be overheated, in which case the lamellar texture is destroyed, and the substance becomes as brittle as glass. In Germany and in France many combs are made, the ornamental part of which is stamped by strong pressure in hot steel dies, and two or more pieces of tortoise shell are united in the same manner; but the colour of shell so treated is injured, besides being rendered very brittle.

The best English makers, after smoothing and rasping the two surfaces that are intended to be united, place them between two thin boards, and insert the whole in the chops of a screw press. The press is put for some hours into boiling water, and is tightened from time to time; and thus, by allowing a sufficient time, a perfect junction is obtained at a heat so low as not to injure either the colour or texture.

¶ *On the Prevention of Dry Rot. By* James Smith, *Esq.*

[From the same.]

The following experiments, showing the effect of lime in preventing dry rot in wood, are extracted from an Essay on the Dry Rot in Timber, by James Smith, Esq. of Leith, and presented by that gentleman to the Society.

I took six kinds of wood as noted below, having two of each piece, or twelve in the whole. These, on the 29th of May, 1822, I buried in a damp confined situation at my lead works, near Edinburgh.

Into one pit I put six of these thin pieces, viz.

1. Scotch larch, fresh and green.
2. Elm, dry.
3. Oak, from a small branch one year cut, good and sound.
4. Ash, green.
5. Scotch fir, green.
6. Scotch fir, dry and half decayed with the dry rot.
7. A piece of wood charcoal.

These I placed on edge and covered them over with the damp soil, that contained a good deal of the decayed leaves, and such other matter as would assist materially to bring on the dry rot. In a second pit, three or four yards from the former, and in exactly the same ground, I sprinkled a quantity of quick lime, sufficient to make the bottom white. I then packed six pieces of wood similar to the above, being a part of the very same wood. These were also put on edge in the same manner. A little quick lime was put on, so as to allow a part to go betwixt each piece, and also to be covered at top, the same as below; then this, also, was covered up with earth, the same as the former, to the depth of twelve inches.

In September, 1823, I examined these two pits, by digging up the specimens of each, which were damp and heavy. The whole of the pieces of wood where lime had not been used were evidently affected with dry rot. I put them into a closet, that they might dry gradually, and I occasionally put them near the air of a fire to assist to dry them, and then again put them by: they had been buried about sixteen months.

In June, 1824, I again more particularly examined each piece of wood, and I found that the six pieces of the first pit were completely affected with the dry rot, apparently more so than when they were taken up in October, 1823, being eight months before. Nos. 3 and 4 are, however, less so than the rest. On No. 4, two vegetable fibres have grown from the wood, four inches long, like gray thread.

The specimens in the second pit, into which lime had been put, were as fresh as when they were first put in. The pieces are harder, and No. 6 appears much sounder than when it was first buried; but No. 6, of the other pit, is quite rotten. The charcoal in both pits has undergone no change.

At the suggestion of Dr. Turner, of Edinburgh, (now Professor of Chemistry in the London University,) I cut off a part of No. 1, which had previously been buried in May, 1822, with lime, also larch, and a piece of Scotch fir No. 4. I also took of fresh wood that had not been so treated,

1. A piece of good dry larch wood.
2. Ditto, rather wet.
3. A piece of Scotch fir, very sound.
4. Ditto, young wood.

These were all buried, in June, 1828, in wet, damp ground, around old leaves and decaying wood.

June 5, 1829, they were all removed and examined; they were all of them wet, and therefore were put into a shed to dry.

July 5, they were all dry; and Nos. 1 and 4, which had been previously buried with lime, were both sound, especially the larch. Of the four unprepared pieces, 1, 2, and 3, were a little affected with dry rot; No. 4 was still more so, and was fast going to decay.

The following extract of a letter from Mr. T. Kirkby, of York, dated November, 1822, bears on the same subject.

"Some twenty-five or thirty years ago, when foreign timber was

very scarce, and consequently very dear, I was engaged in building, and, to save expense, I used English fir for spars and joists; but knowing that the English fir was liable to the dry rot, the idea struck me that the steeping of it in lime and water might preserve it from early decay. I therefore had a trench dug, sufficiently long to admit the pieces of timber to lie in it, and filled it with lime and water of the thickness of a puddle, in which I laid the timber cut up for use, and let it soak for the space of a week; had the timber been larger, I should have allowed it to steep some time longer. It is now twenty-five or thirty years since I used this timber, and it is now as perfectly free from the dry rot as it was at that period."

¶ *On Preventing the Adhesion of an Earthy Crust to the inner Surface of Steam Boilers. By* James Bedford.

[From the same.]

Almost all natural waters hold in solution both carbonate and sulphate of lime, two earthy salts, of which the former is thrown down by bringing the water to a boiling heat, and the latter by evaporation. On this account it is, that if the inside of a steam engine boiler be examined after having been in use for a few days, it will be found to contain muddy water, and an earthy crust will be seen adhering to the iron plates of which the vessel is formed. The rate at which this crust is deposited depends upon the hardness of the water employed, that is, on the proportion of the above mentioned earthy salts which it contains. This crust is a much worse conductor of heat than iron is, and therefore, a boiler lined with it, even to the thickness of a tenth of an inch, possesses the following defects. The water which it contains is not so soon brought up to the boiling point, and a greater quantity of fuel is required to produce a given quantity of steam, because a larger proportion of the heat given out during its burning is carried up the chimney and lost. It becomes, therefore, necessary, from time to time, to remove this crust, which is usually done by a hammer and chisel; but this operation not only incurs a waste of time, but the boiler is often seriously injured, and rendered leaky by means of it.

It has been found that if a few potatoes are thrown into the boiler when it is again filled, after having been cleaned out, the formation of crust is sensibly retarded, and that the adhesion of it to the sides of the boiler is greatly weakened, so as to allow of its being detached more speedily, and with much less hazard.

Another method of producing the same effect has been pointed out to the Society, by Mr. James Bedford, of Leeds, druggist. He put into a large steam boiler between two and three gallons of sperm oil *foots*, and found that after eight weeks' constant use, the deposit of crust was very small compared to what it used to be from the same water alone, and also that the crust could be cleared off by means of a common stiff broom. The application of oily matters for this pur-

pose, though original on the part of Mr. Bedford, is not absolutely new; for the Society have been informed by one of their members, that he has known an iron boiler using Thames water preserved in constant use for seventeen years by cleaning it often, and smearing the inside with oil or tallow after each cleaning.

The Society, however, have reason to believe that neither of the above methods are in common use, and have, therefore, directed this short statement to be published for the benefit of those whom it may concern.

¶ *Description of a Wooden Road.*

[From the same.]

Blackheath Hill, October 6, 1832.

Sir,—It is, doubtless, the duty of every traveller in foreign lands to observe attentively the improvements that have been made in useful arts in the various places through which he may pass; and when he perceives any thing conducive to the happiness, comfort, or prosperity of a people, unknown at home, to communicate the same, for the general benefit of his fellow countrymen.

Under this impression, I take the liberty of soliciting that you will lay before the Society of Arts, &c. the following account of a mode of constructing roads in cities, hitherto totally unknown in England, and by far the most perfect that has ever come under my notice. I think no person will deny that it is desirable to have the streets of towns so paved, that in dry weather there should be no dust, and in wet weather no mud, and as little noise as possible from the passing of carriages. All these advantages are combined in the kind of road I allude to, besides being smoother than a macadamized road, even when the latter is in its most perfect state.

In countries abounding in wood, various schemes have been adopted for the formation of roads of that material; but hitherto they have always been made by laying logs, or planks, parallel to, or at right angles with, the sides of the way; these logs were easily displaced, and soon cut up by the horses' hoofs, and when once out of order, no road can possibly be worse. The improved road, on the contrary, will last five or six years without repair, and, were it not for the high price of timber in this country, might be adopted with the greatest advantage; and being a plan of considerable national utility, possibly the government might be induced to allow the importation of timber for this purpose, duty free.

The following instructions will be found sufficiently practical and explicit as a guide to the construction of roads on this principle.—

1. Prepare a hard and level bed of gravel, or broken stone, covered with sand, and well rolled, about nine inches lower than the intended surface of the road.

2. Take logs of timber of sufficient diameter, and, by means of

equidistant circular saws, cut them into equal lengths of one foot each.

3. These round logs must now be passed under a sexangular steel stamp, which cuts off the outside of the log, and leaves little more than the heart of the tree, in the form of a sexangular block.

4. Two sides of this block must now be bored three inches deep with an inch borer, for the reception of a wooden pin six inches long, which is to be driven into the hole already prepared in the log; the three inches of the pin which project being inserted in the next log. The operation of laying the blocks of wood, and driving the pins, proceeds rapidly, and the surface of the road soon assumes a beautiful chequered appearance, somewhat resembling an inlaid floor; and the fibres of the wood standing vertically, and not horizontally, there is not a possibility of splintering. The whole is held compactly together by a narrow strip of stone pavement, and nothing now remains to be done but to cover it with a thin coat of boiling tar, and on the tar a fine layer of sand, by which means every interstice is completely filled up, and moisture excluded.

In addition to the advantages already mentioned of never being either dusty or muddy, this road is little inferior to a rail-road in point of smoothness; so that it may be safely asserted that one horse will easily draw on it the burden of two.

If at the end of five or six years (where the traffic is great) the road should be so injured as to require repairing, it may be done by taking up the logs, sawing a new face, and replacing them, when the road will be again equal to new.

The one which I saw constructed in the above mentioned manner was in one of the most frequented streets of a populous city, and, when I left that country, had stood between three and four years unimpaired.

Should any further explanation or instruction be required, it will be most readily furnished by,

Sir, yours, &c. &c.

A. Aikin, *Esq.*, *Secretary &c. &c.* James Heard.

Blackheath Hill, October 13, 1832.

Sir,—I hasten to supply the omissions in my communication on the construction of a wooden road upon new principles, by informing you that the first experiment was made in St. Petersburgh, before the house of the governor-general, in the street called the Great Morskoi. After this piece of road had stood several years unimpaired, the plan was tried on a larger scale in the street called the Maloi Millionne; and this trial only served to confirm the good opinion the public had already conceived of this mode of pavement; and, consequently, in the course of last summer (1832,) the Nevsky Perspective, from the Admiralty to the Anitchkin Palace, was paved in a similar way—not, however, from one side to the other (this street being of an ex-

traordinary width,) but two strips, each sufficiently wide for two carriages to drive abreast, the original stone pavement being left in the intermediate spaces.

I neglected also to state, in my communication, that a road constructed in this manner should not be bound together so tight by the side pavement as to prevent the possibility of a slight expansion of the wood from the absorption of moisture. I was led to make this remark by the swelling up of a small piece of foot pavement on a cast iron bridge, where the iron sides preventing the least expansion, the natural consequence of the absorption of moisture was the swelling up of the pavement; but this never occurred where the log pavement was held together by a strip of common stone pavement.

I think it also necessary to observe, that although the above mentioned streets, in which the experiments have been made, are places of so great traffic that roads constructed upon the macadam principle were found of insufficient durability, yet no excessively heavy loads, comparable to the wagons and heavy carts used in England, ever passed over them; I therefore would not pledge myself that such a road (however desirable for the west end of London,) would bear uninjured the enormous burdens continually passing through the streets of the city

I am, Sir, &c. &c.

A. Aikin *Esq. Secretary &c. &c.* James Heard.

CELESTIAL PHENOMENA, FOR JULY, 1834.

Calculated by S. C. Walker.

D.	H	M.	S.						
7	12	21		☿	*g.* elongation		East	26°.3′	
8	3	6		☿	☌ ☾	☿	South	4°.3′	
8	13	22		♀	☌ ☾	♀	South	2°.5′	
29	0			♀	☌ χ Leonis	✳	North	9′	
30	2	22		♂	☌ ☾	♂	North	1°.5′	
30	14	52		♃	☌ ☾	♃	North	58′	
3	13	35	43.3	Im.	♃'s 2 Sat.				
5	14	32	47.4	Im.	" 1 "				
10	16	12	34.8	Im.	" 2 "				
12	16	26	41.0	Im.	" 1 "				
21	12	48	54.3	Im.	" 1 "				
28	14	42	35.9	Im.	" 1 "				
13	8	2		Im.	88 Virginis		,7, N175°	V201°	
13	8	47		Em.			53°	290°	
18	15	35		Im.	155 *s* Sagittarii		,6, 27°	73°	
18	16	52		Em.			347°	397°	
30	13	49		Im.	ε Tauri		,4, 79°	43°	
30	14	39		Em.			324°	283°	

Notice of the Meeting of the Association for the Advancement of Science at Edinburgh.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

I have been requested by the Secretary of the Council of the British Association for the Advancement of Science, to insert in your Journal a notice, that the next meeting of that body will be held at Edinburgh in the week commencing Monday, September 8th, 1834. It is understood that this is an invitation to the scientific men of the United States, and such as may find it in their power to attend, may assure themselves of a most cordial welcome, and a rich repast of science to repay them for their journey.

HENRY D. ROGERS.

Meteorological Observations for April, 1834.

Moon.	Days.	Therm. Sun Rise.	Therm. 2 P.M.	Barometer. Sun Rise.	Barometer. 2 P.M.	Wind. Direction.	Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches.	Inches.			Inches.	
	1	40°	49°	30.00	29.90	SE. S.	Moderate	0.70	Rain.
	2	46	47	29.75	.84	S. SW.	do.	0.99	Cloudy—rain.
	3	38	52	30.20	30.20	NW.	do.		Cloudy—shower.
	4	36	48	.30	.35	N.	do.		Clear—cloudy.
	5	32	47	.40	.40	NE.	do.		Lightly cloudy—cloudy.
	6	36	46	.35	.35	NE.	Brisk.		Clear day.
	7	42	48	.10	.10	NE.	do.		Cloudy day.
	8	51	55	29.90	29.90	NE. SE.	Moderate.		Rain.
	9	51	62	.90	.95	SE. S.	do.	0.95	Rain—cloudy.
	10	42	62	.95	30.05	S. SW.	do.		Cloudy—light clouds.
	11	36	59	30.10	.15	NW.	do.		Cloudy day.
	12	41	70	.16	.16	NE.	do.		Clear day.
	13	45	74	.05	.00	SW.	do.		Clear day.
	14	54	74	29.90	29.90	SE. SSE.	do.		Clear day.
	15	49	72	.80	.75	SW.	do.		Clear day.
	16	50	80	.60	.60	W.	do.		Clear day.
	17	52	84	.60	.60	W.	do.		Clear—hazy.
	18	43	62	30.00	30.00	W.	do.		Clear day.
	19	44	54	.00	.00	SE.	do.	0.22	Cloudy—rain.
	20	49	69	29.94	29.75	NW.	do.		Clear day.
	21	52	70	.73	.80	SE. S.	do.		Cloudy—lightly cloudy.
	22	48	58	.77	.90	S. E.	do.		Cloudy day.
	23	44	52	.80	.75	E.	do.		Cloudy—mist.
	24	46	60	.74	.60	W.	do.		Clear day.
	25	36	52	.64	.70	SW.	Blustering	0.10	Drizzle—snow—drizzle. [night.
	26	33	52	.56	.70	NE.	do.		White frost: cl'dy: rain & snow in
	27	39	44	.50	.50	SW.	do.	0.23	Clear ground covered with snow.
	28	34	61	.50	.50	W.	do.		Clear day.
	29	44	54	.50	.45	E. W.	Moderate.	0.20	Rain—showery.
	30	39	55	.45	.40	W.	do.		Clear day. [cloudy
Mean		42.73	58.23	29.86	29.86			2.49	

Thermometer.		Barometer.
Maximum height during the month,	84. on 17th.	30.40 on 5th.
Minimum do.	29. on 27th.	29.40 on 30th.
Mean do.	50.48	29.86

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